AVIATION WEEK

A McGRAW-HILL PUBLICATION

The Grumman ALBATROSS

Can you identify these two versions of the GRUMMAN ALBATROSS? Originally developed for the Navy, the speed and ruggedness of this big plane make it a favorite of three services. The Air Force flies it on air-sea rescue operations. The Navy and Coast Guard use it as a utility amphibian. Give yourself an "A" in aircraft identification if you recognized the ALBATROSS in flight as "Navy" . . . the ALBATROSS taking off as "Air Force."

Grumman

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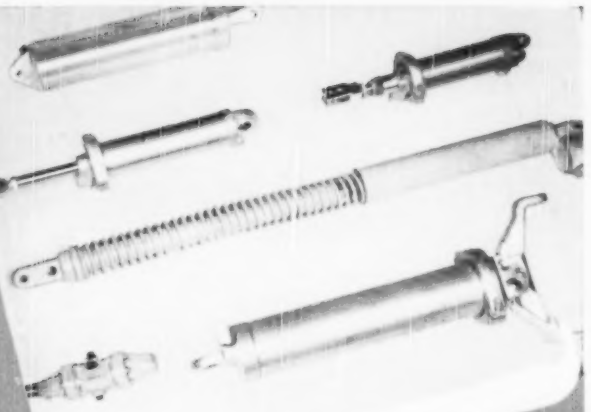

Precision parts and sub-assemblies, made to customers' specifications, are an Ex-Cell-O specialty. Typical of Ex-Cell-O's products for the aircraft industry are the precision parts (at left) and hydraulic assemblies (above) shown on this page. Ex-Cell-O has complete engineering, machining, heat-treating, grinding, sub-assembling, and inspection facilities— all under one competent, experienced management. Ex-Cell-O makes precision parts to your specifications, in small or large volume, and delivers them in accordance with your schedule. To see how this service can benefit you, write Ex-Cell-O in Detroit today.

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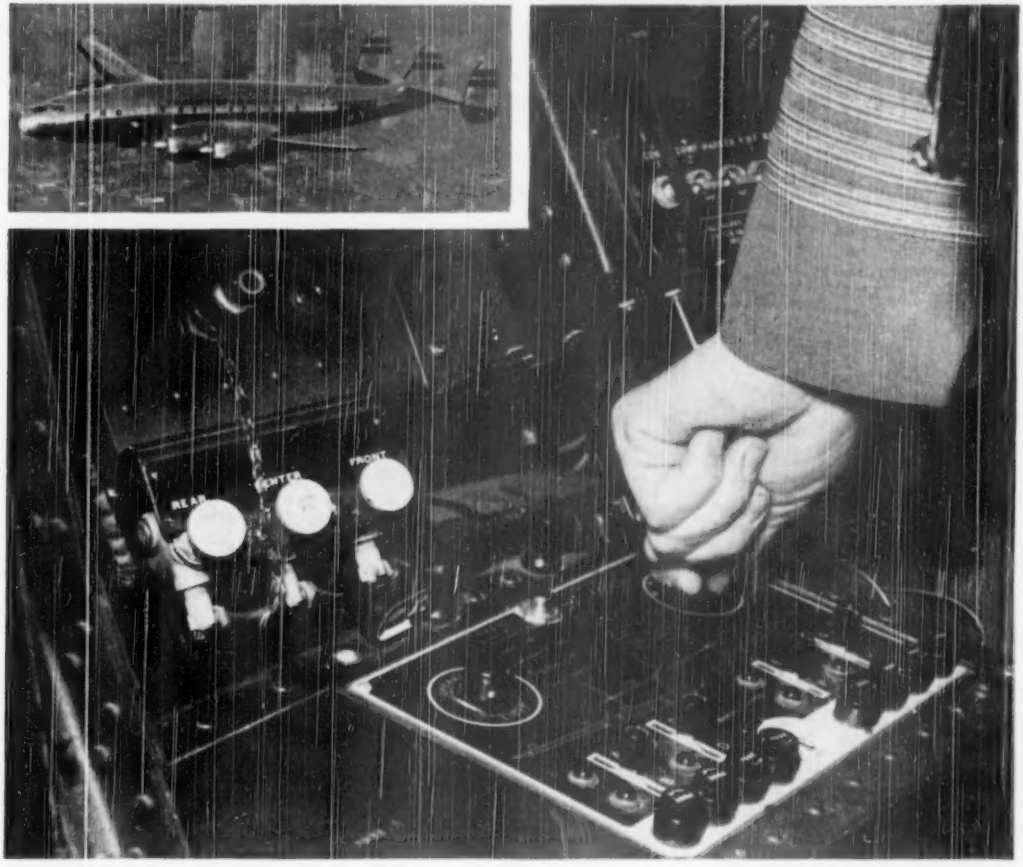

New control puts each De-Icer at the pilot's fingertips

ONE PLACE where there was room for improvement in De-Icers was the control system. Pilots wanted closer, more complete control of the de-icing operation.

B. F. Goodrich engineers had some ideas on how it could be done. They got together with Eclipse-Pioneer designers. The result is shown above on a Trans World Airline Constellation. It's a new electronic timer that lets the pilot choose his weapons for fighting any kind of ice he finds!

With this new control, a pilot can operate just one De-Icer group at a time—or all of them at once. He can set the inflation-deflation cycle for light, moderate, or heavy icing—and for high altitude operation. He can have manual or automatic operation.

The new system offers other big advantages too. Solenoid valves inflate and deflate the De-Icer much faster. Maintenance is easy and centralized. A special filter arrangement removes *all* oil vapors from air entering the De-Icer, improving the operation and increasing the life of the boot.

B. F. Goodrich De-Icers with this latest-type Eclipse-Pioneer plumbing system are now in use on all new 749A-type Constellations—as well as several other transport and military aircraft in the U. S. and Canada. This is another example of BFG research in aircraft icing problems. *The B. F. Goodrich Co., Aeronautical Division, Akron, Ohio.*

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Aviation Week

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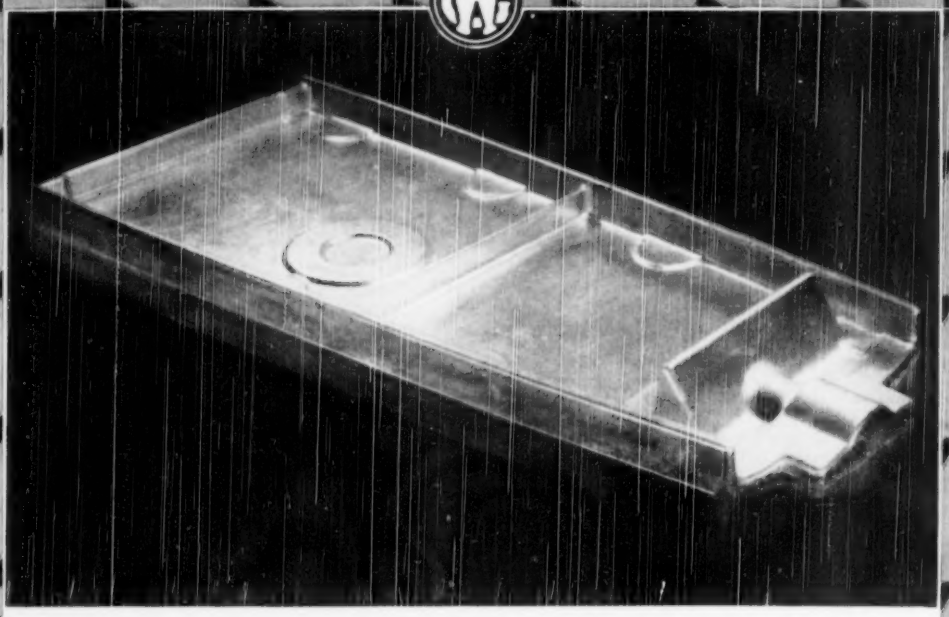
Fafnir duplex external self-aligning super-precision ball bearing jet engines. Handles heavy thrust loads and maintains shaft rigidity despite powerful gyroscopic forces, wide temperature variations and speeds up to 12,000 r.p.m.

used by Westinghouse for the main rotor shaft of



Are you taking full advantage of the constantly growing range of forgings? Typical is this aluminum alloy forging with a projected area of more than 1,000 square inches used in the wing structure of a modern military bomber. Such forgings are today made possible by the use of the largest die forging press in America (18,000 tons).

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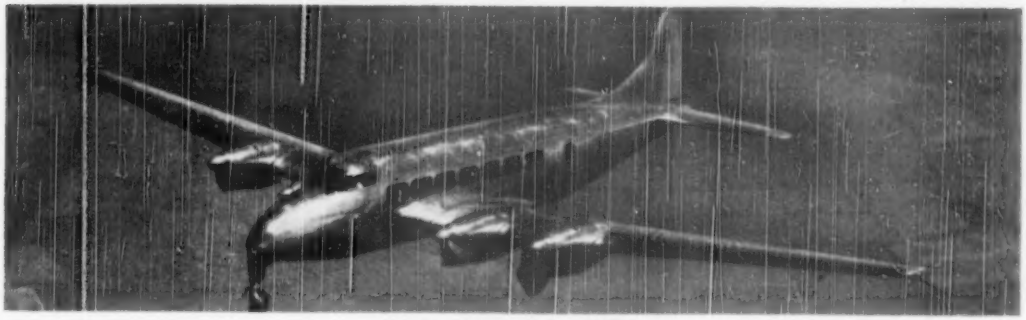
New Foreign Planes in the News . . . .



FEEDERLINE TRANSPORT

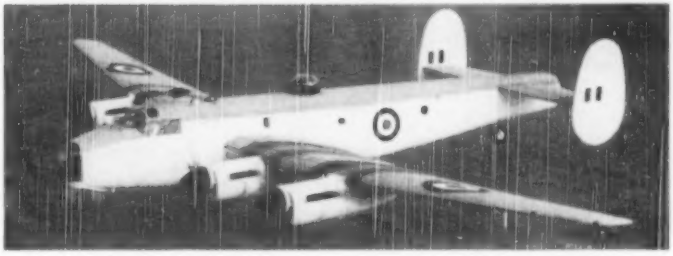
De Havilland Heron in the air during flight trials bears close resemblance to de Havilland Dove, from which it is descended. Heron is a 14-17 seater and is powered by four DH Gipsy Queen 30 engines. It has fixed tricycle gear for easier maintenance. It is designed for economical operations on stage lengths of 600 mi. It is priced at $98,000.

ADVANCED TRAINER

Avro Athena returns to the factory after completing a 3½-month demonstration tour of India and several Middle East countries. Note immaculate condition. The only replacements required during the tour were a canopy panel accidentally broken and a new set of tires. The trip to India was made in eight stages at an average speed of nearly 210 mph. Fuel consumption, at 10,000 ft., was 37 gph. The Athena is powered by a 1060-hp. Rolls-Royce Merlin.

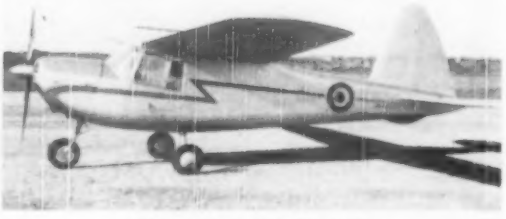
AVRO SHACKLETON

Long-range over-water reconnaissance plane shows large radome fitted over nose. It is designed to replace the obsolete Lancasters now being used by RAF Coastal Command. This production-line model Shackelton differs from the original model in that nose and tail turrets have been removed, leaving only dorsal turret. The four Rolls-Royce Griffons turn counter-rotating props and are housed in new-type circular cowlings.



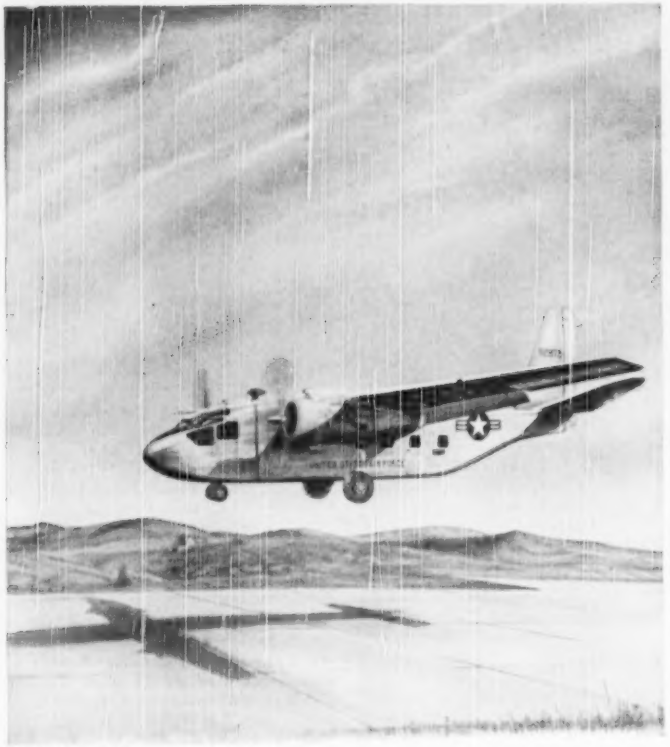
MACCHI MB-320

New twin-engine design seats six, including the pilot. Powered by 185-hp. Continentals, top speed is approximately 200 mph. Construction is all-wood. Tricycle landing gear is retractable, with nose wheel folding forward and up into nose.



ITALIAN LIGHTPLANE

MB-308 is an all-wood two-place personal plane by Macchi. Top speed is about 125 mph. with 85-hp. Continental C85 installation. Fitted with twin float gear and 90-hp. engine, top speed is about 120 mph. Aeromatic prop is used.



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AVIATION CALENDAR

June 19-23—American Society of Mechanical Engineers semi-annual meeting, with Institute of Aeronautical Sciences and American Helicopter Society joining ASME aviation division in two helicopter engineering sessions, St. Louis.

June 21-25—Ninety-Nines 1950 convention, Ft. Clark Guest Ranch, Brackettville, Tex.

June 26-30—53rd annual meeting, American Society for Testing Materials, ninth exhibit of testing apparatus and related equipment, Chalfonte-Haddon Hall, Atlantic City, N. J.

June 29-July 1—1950 national meeting of Institute of Navigation, San Diego, Calif.

July 1-4—Ninth annual West Coast championship soaring contest, sponsored by Southern California Soaring Assn., El Mirage Field, Adelanto, Calif.

July 7-8—Royal Air Force 1950 display, Farnborough airfield, England.

July 10-28—Air Age Institute lecture series, Parks Air College, E. St. Louis, Ill.

July 12-14—Annual summer meeting of the Institute of Aeronautical Sciences, western headquarters building, Los Angeles.

July 14-16—National pilots air meet, including a national airplane trading day, sponsored by Chattanooga Flyers Club, Chattanooga.

July 16—Third efficiency race and air show, sponsored by Mansfield Aviation Club, Inc., Mansfield, O.

July 21-23—9th annual all-Ohio air tour, sponsored by Cleveland Junior Chamber of Commerce.

Aug. 2-13—17th National Soaring Contest, Grand Prairie, Texas.

Aug. 7—Lions Club Air Meet, Sky Harbour Airport, Goderich, Ontario, Canada.

Aug. 7-18—Special two-week program on high temperature ceramics, Massachusetts Institute of Technology, Cambridge, Mass.

Aug. 7-20—First United States International Trade Fair, Chicago.

Aug. 19—Tennessee air progress conference, Knoxville.

Aug. 19-20—California Air Freight Clinic, sponsored by Calif. Aeronautics Commission and Oakland Chamber of Commerce Aviation Committee, Oakland.

Sept. 2-4—National Air Races, Cleveland.

Sept. 5-0—Eleventh flying display and exhibition, Society of British Aircraft Constructors, Farnborough airfield, England.

Sept. 7—Pratt & Whitney distributor operation and maintenance meeting, Pacific Airmotive Corp., Linden, N. J.

Sept. 10-14—Instrument Society of America instrument conference and national exhibit, the Coliseum, Houston, Tex.

Sept. 18-22—Fifth national instrument conference and exhibit, Memorial Auditorium, Buffalo, N. Y.

Sept. 28-30—14th annual convention of International Northwest Aviation Council, Sun Valley, Idaho.

Oct. 26-27—5th annual aviation conference, sponsored by aviation committee of Tucson Chamber of Commerce.

PICTURE CREDITS

7—De Havilland, McGraw-Hill World News; 12—United Aircraft Corp.; 14—Bell.

NEWS DIGEST

DOMESTIC

Prototype legislation chances dimmed when Sen. Herbert H. Lehman, New York, on recommendation of an independent air carrier, blocked unanimous consent passage. Congress is shooting for August adjournment and has a heavy calendar of "must" business. If no place is found on the agenda for prototype bill it will die with adjournment, have to be introduced all over again in next Congress.

Northrop X-4 will begin test flights in the transsonic speed range, following completion of USAF acceptance tests on two X-4s by Northrop crews. NACA test pilot John H. Griffith will conduct the tests.

Airlift of migratory farm workers from Puerto Rico to Saginaw, Mich., was begun by Pan American Airways and Eastern Air Lines after the governor of Puerto Rico banned further passenger flights by uncertificated contract operators following the Westair crash (AVIATION WEEK June 12). With 3500 workers to be moved by June 20, PAA alone in four days lifted 1540 on 28 flights, at $90 per head.

Jerome Lederer, president of Flight Safety Foundation, was presented a cup by Sigmund Janas, Colonial Airlines president, for "excellent and outstanding contributions to safety in the air throughout the year" 1949. This was the first of what Janas hopes will become an annual award bestowed by airlines such as Colonial with outstanding safety records.

James A. Phillips, Jr., president of Phillips Aviation Co., Burbank and South Pasadena, Calif., died after a heart attack. He was 49. Phillips established his aircraft parts business in 1935.

Fewer intermediate fields and beacon lights will be maintained by CAA. A use study has convinced CAA that it needs intermediate fields only every 200 mi. in flat terrain. The 100-mi. spacing will be continued in rough terrain. Beacon lights will mark only airports, hazards or points on an airway in mountainous terrain.

Trans American Airways President Edward Ware Tabor announced that nonscheduled airlines are raising a war chest to fight additional CAB curbs on the independent operators' flight frequencies.

General Electric Co. will try to determine service life on the J-47 engine and its components by an accelerated testing program with a North American B-45 bomber powered by four of the J-47s. The B-45 was turned over to GE by the Air Force. Another aim of the project is to plot overhaul intervals and modifications. It is the first jet plane to join GE's variety of test planes which includes the well-known B-29 with J-47 engine suspended from bomb bay.

FINANCIAL

Fairchild Engine & Airplane Corp. declared a dividend of 20 cents a share payable June 28 to holders of record June 17. It was the company's first mid-year dividend. Another dividend will be considered later in the year.

Continental Motors Corp. reports earnings of $912,658 for the quarter ending April 30 on sales of $24,666,612. Six months' earnings were $1,374,351 on sales of $40,635,615. Both second quarter and six month results were ahead of a year ago.

INTERNATIONAL

Cierva Air Horse, world's largest helicopter, crashed near its home base at Southampton, Eng., last week, killing Cierva's chief test pilot and manager, Allan Marsh, and the Ministry of Supply chief rotary test pilot, F. J. Cable, and a flight engineer. The three-rotar craft, designed to carry 24 passengers or three tons of cargo, was powered with a 1620 hp. Rolls-Royce Merlin engine, and had carried its full gross weight of 17,500 lb. in flight.

Israel and U. S. have signed a bilateral air transport agreement providing reciprocal landing rights. TWA now flies between New York and Lydda and CAB is expected to authorize similar operations by El-Al, Israel National Airlines.

India will pay subsidy to its operators of air transport services. For a trial period, April-August, payments will be based on amount of gasoline used. Future financial assistance will be considered later.

Howard F. Rough has been named U. S. civil aviation advisor at Paris for both CAA and State Department. He has been CAA assistant to administrator for field relations.

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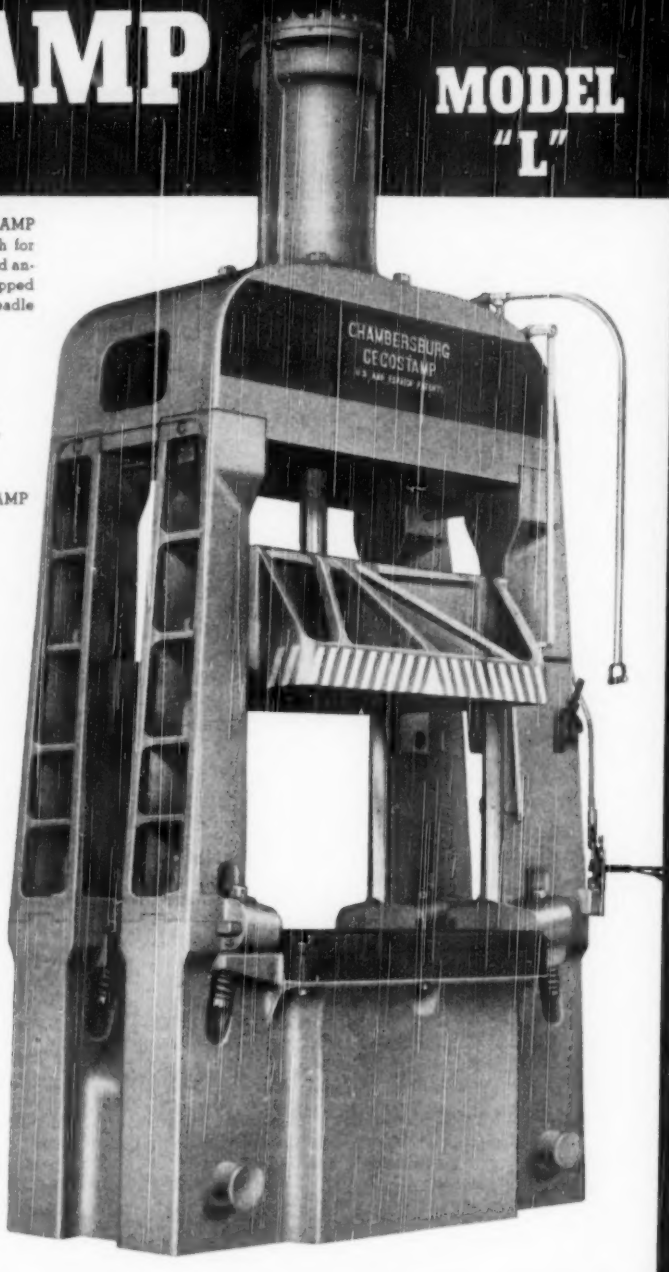

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WHO'S WHERE

In the Front Office

Archibald M. Brown, Jr., has been named vp-sales for Edo Corp.; and **William R. Ryan** has been made vp in charge of engineering. Brown was previously Edo's general sales manager. He joined the company in 1935, in 1938 became manager of the Port Washington seaplane base and a year later was sales manager of Fairchild's aircraft manufacturing division. He rejoined Edo in 1947. Ryan, previously director of engineering, joined the concern in 1946. Brown succeeds **George Post**, who retired because of ill health last year. Ryan takes over the position vacated by **B. V. Korvin-Kroukovsky** now with Stevens Institute.

David D. Mason has been appointed vp-controller of Link Aviation, Inc. He was formerly controller of Ansco and has been with the production and inventory control section of Bendix Aviation.

Changes

▶ **With the Manufacturers**—**George H. Selvin** has been named chief engineer in charge of standards and engineering sales for Nutt-Shel Co. . . . **Robert E. Ward** and **Ralph D. Ferguson** have been appointed manager and sales manager, respectively, of Eclipse-Pioneer division's foundry at Teterboro airport. **Louvan E. Wood** is new chief engineer of Bendix Aviation's Friez Instrument division . . . **J. R. Clark** and **Raymond C. Blaylock** have been made asst. chief engineers of Chance Vought Aircraft division.

C. A. Hulsemann has been appointed manager of a new industrial brake sales dept. of Goodyear Tire & Rubber Co. It will function as part of the firm's aviation products division . . . **Glen T. Lampton** has joined the aeronautical engineering dept. of Hughes Aircraft as design staff engineer, armament.

▶ **With the Airlines**—**Capt. Joseph J. Kelley** has been promoted to eastern division operations manager for Eastern Air Lines, replacing **Capt. E. H. Parker. William L. Morrisette, Jr.**, has been named EAL's traffic and sales manager for New England.

M. B. Joyner has been appointed Trans World Airlines' supt. of station service overseas . . . **Herman R. Semmelink** has been named Canadian rep. for Royal Dutch Airlines (KLM), succeeding **William DeMier** who has been transferred to KLM's offices in Europe . . . **Robert P. Hubley** has been appointed general sales manager for California Central Airlines and will handle sales developments in CCA's terminals at Los Angeles, San Francisco, Oakland and San Diego.

▶ **Correction**—**C. L. Stewart** has been named asst. secy. of Northwest Airlines. He was inadvertently identified in this column May 29 as a Western Air Lines official.

INDUSTRY OBSERVER

▶ **Air Materiel Command helicopter researchers are continuing their project for experimental towing of helicopters behind fixed-wing planes to extend copter range, despite Washington reports (AVIATION WEEK May 29) that USAF considers the towing speed too slow to be practical for long-range rescue work. Principal tow tests thus far have been confined to the Sikorsky S-51 in auto rotation. But project calls for similar tests eventually on the larger Sikorsky H-19 and the Piasecki H-21.**

▶ National Advisory Committee for Aeronautics now has a sizeable stable of research planes at Edwards AFB, Muroc, Calif. USAF and Navy have turned over to the research agency the transsonic and supersonic research planes they originally purchased and flew, including: Douglas D558-I Skystreak, D558-II Skyrocket, one of the Bell X-1s and the Northrop X-4. Presumably however the three forthcoming Bell research planes, X-1A, X-2, and X-5 (AVIATION WEEK May 30, 1949) will go through USAF flight trials at Muroc before NACA gets to fly them.

▶ **Rolls-Royce and Pratt & Whitney have come to a parting of the ways on Anglo-American turbine engine development. No further collaboration is expected after any remaining details of the Tay-J-48 joint program are cleaned up. The decision represents a change in plan, for Pratt & Whitney had previously indicated intention of continuing engineering cooperation with the British engine firm (AVIATION WEEK March 6) on subsequent powerplants.**

▶ Civil Aeronautics Administration technical service is prepared to accept British certification of transport jet engines, such as the de Havilland Ghost, if any American manufacturer wants to use them in his planes, but would still certificate the particular plane installation.

▶ **Curtiss propeller division or Curtiss-Wright will soon make delivery on the rocket engine for the Republic XF-91. The Curtiss engine for the XF-91 has four 4000-lb. thrust cylinders, while the Curtiss engine for the Ball X-2 develops a total or 15,000-lb. thrust from two cylinders, one giving 5000-lb. thrust, the other 10,000 lb.**

▶ Bell Aircraft Corp. is about ready to roll out the X-2 research plane, but is still waiting for the Curtiss rocket engines. Bell's first X-1A, an improved version of the X-1, will be ready about next January. This is to be powered by a reaction motors rocket engine developing 6000-lb. thrust, as does the engine in the X-1, but using a turbo pump which will reduce weight of the engine installation and give a longer firing period.

▶ **The de Havilland Dove, twin-engine, eight-place transport, has received its U. S. airworthiness certificate and the Canadian de Havilland company is now expected to launch a strong U. S. sales drive. It will be aimed at the executive rather than feeder market. The Dove will sell for about $60,000, compared to something over $70,000 for the Beech Model 18, closest comparable U. S. transport.**

▶ Etablissements Fouga et cie, France, has changed the name of its single-seat turbojet-powered lightplane from Cyclone to Sylphe. Basis for the change is a protest from Wright Aeronautical Corp., claiming proprietory rights to the name Cyclone. Sylphe, undergoing first flight tests this month, is a powered version of C.M.S-13 sailplane acrobatic trainer. Designated C.M.S-R-13, the plane was developed as a test bed for the turbomeca Pimene turbojet engine. Developing 176-lb. static thrust, Pimene weighs 110 lb. fully equipped. It is mounted in the Sylphe above the fuselage just aft of the cockpit. Fouga has also under construction a two-place powered version of its C.M.S-15 glider. It will be powered by a new Turbomeca axial-flow turbojet developing 660-lb. thrust. Both single- and two-place planes feature midwing cantilever construction and butterfly tail surfaces.

▶ **Societe Nationale de Constructions Aeronautiques du Sud-Ouest has entered the commercial jet transport development race. Engineering studies are under way using a modified version of the SO 30P Bretagne airliner. The 30-place twin-engined transport mounts two Rolls-Royce Nene Mk. 5 centrifugal-flow turbines in place of regular Pratt & Whitney R-2800-B43 1600-hp. engines.**

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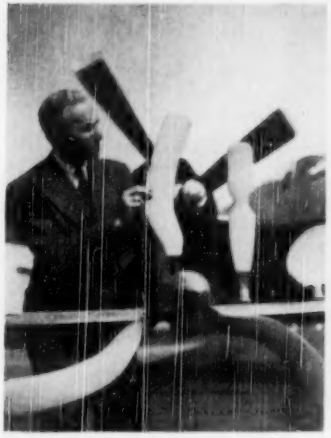
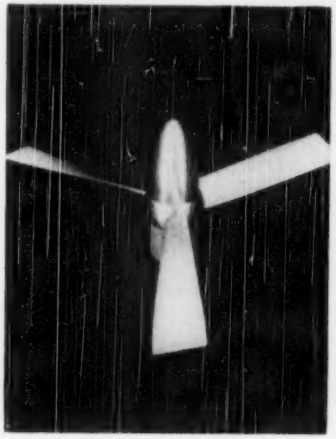
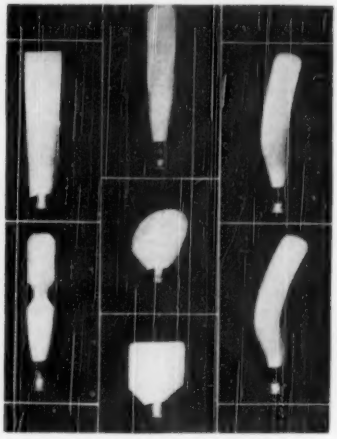






TEST BLADES of Ham Standard assumed many shapes. Left, chief aerodynamicist George Rosen with sweptback blade, one with narrow midsection supposed to ward off compressibility and a swept stub configuration. Center seems the answer: thin blades, square tips. Right, more ideas: upper left, thin blade; top center, World War II blade; top right, moderate sweep back; center, sweptback stub blade; lower left, narrow midsection; lower center, stub; lower right, extreme sweep back.

Props to Drive Planes Faster Than Sound

Tunnel tests offer conclusive proof that supersonic propeller flight not far off.

By Alexander McSurely

Supersonic flight in propeller-driven airplanes—long believed physically impossible—is now assured on the basis of wind tunnel tests. In the not too distant future it will be a reality, bringing with it promise of important new economies in high-speed flight.

Work now being done indicates that about 18 months from today the first supersonic turboprop-driven airplane may slice its way through what was once considered an impenetrable sonic "barrier" to propeller aircraft.

Leading U. S. propeller designers today are confident that they have their old arch enemy, compressibility, on the ropes waiting helplessly for the knock-out punch.

Today they are testing new ultra-thin straight blades in scale model propellers with diameters of three and four feet.

Hamilton Standard division recently disclosed that in high speed propeller model tests in United Aircraft's wind tunnel, airstream speeds equivalent to Mach 0.92 (equivalent to 700 mph. at sea level) had been attained.

▶ **Miracles Will Help**—It is understood that Aeroproducts has attained very high speeds in tests of model propellers.

Still to be accomplished before a supersonic prop-driven plane can take its place beside the Bell X-1 first supersonic plane (AVIATION WEEK Dec. 22, 1947) and other later supersonic airplanes, are the following steps, all requiring some fair-sized engineering and production miracles:

- **Full-scale blades**, at least as thin as the model blades, yet very wide of chord, and super strong to take the terrific loads imposed at supersonic forward speeds, must be produced.
- **Problems of propeller** gearing and controls, major headaches of the first turboprop engines, must be overcome.
- **The turbine engines** themselves must be developed to a point of greater reliability and to powers well beyond those of the first turboprops now flying.

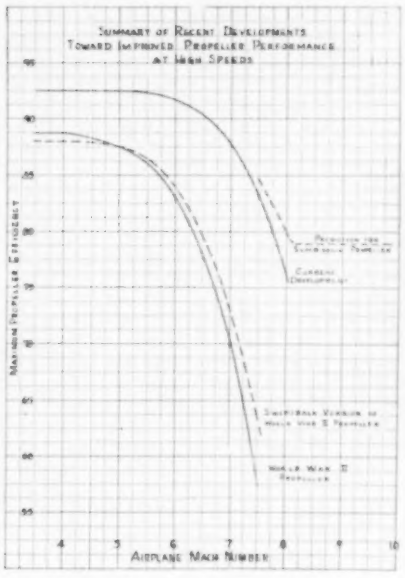
Development and research credits for the forthcoming supersonic propellers can be divided between the Navy, National Advisory Committee for Aeronautics and the three principal U. S. propeller manufacturers, Aeroproducts, Hamilton Standard and Curtiss-Wright. The Air Force made the mistake of writing off the propeller as obsolete when turbojet power came along. Only belatedly did the USAF climb back on the propeller bandwagon, when their error became obvious.

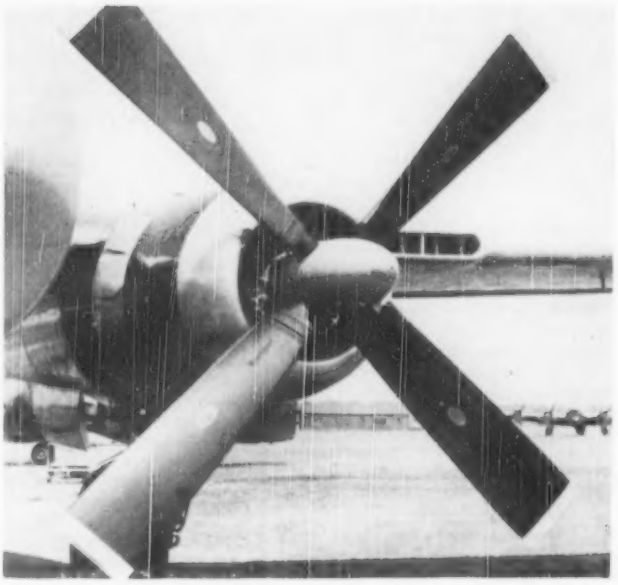
On a basis of turbine propellers now flying, Aeroproducts has a lead over its competitors. Four six-bladers from the General Motors division at Dayton are whirling at the nacelles of the Convair XP5Y-1 turboprop flying boat, while a fifth six-blader hauled the Douglas A2D Skyshark attack plane up into the sky two weeks ago for the first time. All these are fitted to T-40 double turbine powerplants, built by another GM division, Allison. Yet another Aeroprop rotates at the shaft of the big Turbodyne II turboprop engine, developed by Northrop, but never yet flown.

Hamilton Standard has recently announced a new eight-blade dual rotation propeller developed for the Navy, for turboprop use, which will undoubtedly figure in the high-speed propeller future picture.

Historically, Aeroproducts had a four-blader on the first flight of what is claimed to be the first turbine-propeller plane in the U. S. to fly, the Convair XP-81 experimental Air Force fighter. A Hamilton Standard propeller was also used later on this plane. Another Hamilton Standard propeller was fitted to the General Electric TG-100 powerplant in the nose of the Ryan XF2R-1 experimental Navy fighter.

None of the propellers now flying are in the supersonic class, at least with their present power and their present planes.





PROMISE of supersonic propellers is summarized graphically in chart at left. Efficiency will level off at a high figure in the transsonic zone, in contrast to the fall-off indicated for both former and existing configurations. Propeller at right, Ham Standard's Turbo-Hydromatic, is one step removed from the supersonic prop, being comparable to the "current development" on chart. This prop already has been test flown with conventional engines and is designed for both single rotation and dual rotation.

▶ **Will It Be A2D?**—But perhaps the Douglas A2D isn't too far away from becoming the first supersonic propeller-driven plane, as Douglas engineers recently hinted (AVIATION WEEK June 12). It is credited with a speed of around 550 mph. in level flight with its present engine-propeller combination. Engineering indications are that the plane, with additional thrust, might be stepped up to speeds between 600 and 700 mph.—under certain conditions right around the Mach 1 line, with additional thrust. Presumably this would be supplied partly by further improvement in propeller blade design, and partly by additional shaft hp. from improved turbines.

To appreciate fully the radical change which has taken place in propeller design theory, you must remember that until recently, the boldest propeller engineers put the top limit for a propeller-driven plane somewhere around 500 mph.

Actually about the top speed propeller-driven fighters of World War II were able to attain in level flight, was right at the 500-mph. mark. The main trouble was that with the propeller blades of those days efficiency began to drop off rapidly as the plane speeds increased beyond the 350-mph. mark.

This was because the propeller tips were moving at speeds faster than the airplane's forward motion. (Blade-tip speed is made up of two factors, forward speed of the airplane, plus the rotational speed of the propeller.) And as soon as the tip speed got up into the transsonic region, the blade ran into compressibility troubles, which became worse and worse as the speed increased.

If still more power was added, the shock waves would twist up the propeller into a pretzel, the engineers concluded.

▶ **Why So Bold?**—But why is it then, that such a big jump in propeller airplane speeds is now confidently forecast by authorities, such as Dr. Hugh L. Dryden, research director of NACA, in Congressional testimony, and Rear Admiral C. M. Bolster, Navy Bureau of Aeronautics assistant chief for research before the Institute of the Aeronautical Sciences?

The explanation lies in the aerodynamic research which has been applied to propeller blade design in the intervening years since World War II's end.

The basic secrets of making an airfoil which can slip through the transonic range without piling up an impenetrable mass of air at its leading edge, are now available to every top aerodynamicist. And they apply equally to propeller blades and airplane wings.

In simplest terms, a supersonic wing or propeller blade can be shaped either by making it very thin, or by sweeping back its leading edge so that all the leading edge does not take the shock wave at the same time. And if the wing, or blade, is both thin and swept-back, so much the better, as far as its transsonic penetration characteristics are concerned.

▶ **Straight and Narrow**—Sweep-back was tried by most of the manufacturers, but has been largely discarded. Structural problems involved in making a sweep-back propeller that can take the necessary loads are far greater than those of making a straight-blade propeller. And the same results can be achieved by thinning the blade. A Hamilton Standard sweep-back propeller showed only moderate improvement in efficiency over a World War II propeller, and was much lower in efficiency than a straight-blade thin propeller. (See accompanying chart.)

It is important to differentiate between a supersonic propeller and a supersonic propeller-driven airplane. Propellers moving at supersonic speeds are not new. Ever since World War II and possibly even a little before, propeller designers have been dipping into the supersonic speeds with thin propeller tips. The big 18-ft. Curtiss propellers on the Convair B-36 have supersonic tip speeds. Some helicopter rotor blades, too, have tip-speeds in the supersonic area, but getting the whole propeller to perform efficiently while pulling a plane through supersonic speeds takes more development.

How thin will the blades be? Current blades for high-speed propellers now fly-

ing are only about half as thick as the blades of the World War II propellers, and they permit relatively high propeller efficiency up to around 600 mph.

To achieve reasonable efficiency at around Mach 1, George W. Brady, Curtiss propeller engineer, estimates that the thickness-to-chord ratio of the blade at the tip must be about 2 percent as compared to 8 to 10 percent ratio of today's conventional propellers.

George Rosen Hamilton Standard chief aerodynamicist, predicts increasing refinement of propeller design, practices will accompany the developments from here on.

There will be little, if any, change in the weight of a propeller of given size, with the change in blade thickness being the principal structural change. There will be increased effort to design more closely to the ultimate capacity of a propeller blade, with greater attention to analytical methods, and study of where the loads will eventually be on the blade.

►**Simplification Seen**—Once propellers are developed to get through the transsonic range, comfortably there may be some simplification of propeller designs.

Heretofore with a limiting compressibility factor to slow rotational speeds of the propellers, it has been necessary to absorb increased power by adding more propeller-blade area. This led eventually to four-blade and later to six-blade and eight-blade dual rotation propellers. However if the propeller can be turned more rapidly without great efficiency loss, a smaller blade area will absorb equivalent power so that there will not be need for dual rotation propellers in some of the power ranges where they are now required.

There is also the possibility of cutting down the reduction gear ratio now needed for propellers. For turbines, currently, the ratio is something like 10 to 1. But if the propeller of advanced design can be whirled more rapidly than sonic-tip speeds without difficulty, the ratio might be cut down eventually to as much as 5 to 1 with a resultant saving in weight and cost, engineers predict.

Main economy of the propeller-driven airplane however is in its efficiency at low speeds for takeoff and climb, as compared to the turbojet airplane. And it is here where the economy of the high-speed propeller aircraft is expected to make itself felt most.

At any speed below 375 mph, the propeller-driven plane is more efficient than the jet-powered plane. And the slower the speed, the greater the advantage on the side of the propeller, assuming that the horsepower of the propeller plane is equivalent to the thrust-pound of the jet plane.

Anti-Sub Copter

Bell wins competition for Navy contract with tandem rotor design.

Bell Aircraft Corp. last week came out winner in a hotly contested sales battle royal with nine other manufacturers, to receive the Navy's contract for development of a big new antisubmarine helicopter.

Contract for production of three experimental prototype helicopters plus the engineering was unofficially reported at close to $5 million. Negotiations for the contract have been authorized, now that the competition has been decided.

The new machine will be twice as big as anything Bell has yet built, weighing 13,000 lb. gross weight. It will be powered with a Pratt & Whitney R-2800 engine rated at 2300 hp. It will represent the first departure of the Bell organization from the older main-rotor and tail-rotor configuration, to the twin tandem rotor configuration which appears to be catching on as the new style in larger rotary wing aircraft.

(Bell's plan to build a tandem rotor copter for this competition was first disclosed in AVIATION WEEK April 10.)

The antisubmarine copter is expected to be much faster than the current crop of helicopters and capable of carrying sufficient radar search equipment and submarine weapons to be a deadly attacker of the undersea craft.

Bell has built approximately 300 small helicopters for commercial use, and a considerable number of two-place military craft, as well as 11 of its larger YH-12B machines for the Air Force. The company also has plans for developing the 600-hp. YH-12B, which has a 6286-lb. gross weight, into a commercial passenger craft designed to carry 11 passengers with an 800-hp. engine.

To win, Bell had to beat out virtually every recognized helicopter firm in this country. Competitors included: Piasecki, Sikorsky, Curtiss-Wright with a Doman design, McDonnell, Kellett, United Helicopters Inc. (Hiller), Kaman, Gyrodyne and Hughes Aircraft.

At stake was one of the juiciest contracts yet available for the struggling infant helicopter industry. It will give Bell a strong advantage in development of both military and commercial craft. Some other designs entered, included such radical devices as: Pusher propellers at the tail to increase forward speed, and stub wings to carry some of the forward rotor loading, another factor in getting higher speeds.

Johnson Plane Ban May Kill Air Races

Unless Defense Secretary Louis Johnson has an unlikely change of heart, the 1950 National Air Races at Cleveland will probably be called off.

Fred Crawford, National Air Races President, told AVIATION WEEK in Cleveland last week that Johnson might change his order disapproving participation of Air Force and Navy planes

A THREE-BELL PICTURE

A trio of Bell 47-D1 copters hovers at the company plant near Niagara Falls, N. Y., before flying to New York City where they went into service with the police department (AVIATION WEEK June 12). The copters replace an earlier model Bell which had been in service two years. The New York Police Department will use them for steady service in traffic control, search and rescue.

at the 1950 races. Crawford said Johnson had told the Air Race officials; "If the Chiefs of staff ask for permission to send the planes to the races, then that will be a different matter.

▶**In Washington**—A spokesman for the Defense Department told AVIATION WEEK that the matter was not scheduled to come before the Joint Chiefs of Staff and that the subject is closed. Johnson's letter to Crawford on the subject was explicit. "For reasons of training and economy I feel it mandatory that we curtail all other forms of public military demonstrations," he said.

For the last several years the chief attraction of the races has been high-speed flight and precision acrobatics of the latest combat aircraft as well as static display of virtually all of this nation's aeriel might. Industry-sponsored races, which rounded out the classic, have proportionately dwindled as the gulf in speeds between military and civilian aircraft widened.

▶**Dangerous Risks**—Military aircraft have experienced near misses in mid-air crashes with stunting planes in the circus spectacle of the air show. Military pilots in making speed runs across the air race grandstands have, on several occasions, nearly piled-up as cross currents and eddying winds upset the delicate control of their planes speeding only a few feet above ground.

For the last three years the Navy and Air Force have annually considered withdrawal from the races. Value of military participation from a publicity point of view was weighed in light of the overall costs of participation and the hazards of the operation.

▶**Cost**—Race officials, last year, paid over $40,000 to defray costs of USAF, Navy, and National Guard aircraft operating in the show. That amount, however, was only a fraction of the actual cost of participation. Race enthusiasts and some military officials have attempted to lay remainder of the costs of military participation to training.

Aircraft industry executives concerned with keeping their planes favorably in the public eye have suffered annually over the prospect that one of their planes may crash out of public favor. For example, two years ago, after the mid-air explosion of a Lockheed F-80 just beginning its sweep across the airport area during the All American Air Maneuvers at Miami, the Air Force was deluged with letters protesting races and airplanes in general and the Lockheed F-80, in particular.

The Canadian government, which each year has sent a delegation of pilots and planes to the races, will also probably decline acceptance of invitation to participate in the races. According to Canadian official spokesmen, that government had sent men and planes to the races previously only as a "hands-across-the-border" gesture.

Only event currently set so far, for this year's show, are the midget races (190 cu. in. displacement) which will be sponsored by Continental Motors Corp. Prize money for the race elimination and a special consolation prize remains at $25,000. This class was started in 1947 and was sponsored for three years by Goodyear Tire & Rubber Co.

Liaison Competitors Hit Cessna Choice

Piper Aircraft and Taylorcraft, Inc., have filed protests on Army's decision to purchase through USAF up to 500 Cessna L-19 (Model 305) liaison-observation aircraft. About one-fourth of the planes will be assigned to National Guard use.

The Army decision was based on the recently completed aircraft competition between five lightplane manufacturers at Wright Field, Ohio, and Ft. Bragg, N. C. (AVIATION WEEK June 5).

Piper and Taylorcraft, in letters to Secretary of Defense Louis Johnson, both asserted that Cessna Model 305 exceeded by nearly 500 lb. Army's competition requirement that empty weight not exceed 1000 lb. Piper PA-19 empty weight is 1070 lb. Taylorcraft Model 18 empty weight is 1080 lb. Cessna's entry featured a 213-hp. Continental E-190 engine while the Piper and Taylorcraft entries were equipped with 125-hp. Lycoming engines.

Johnson has "referred the letters, through channels, for investigation," according to an official spokesman.

Technical evaluation of all five entries—Cessna 305, Luscombe T-8F-L, Taylorcraft 18, Piper PA-19 and Fletch FL123—was conducted by USAF at Wright Field. Tactical evaluation of the competing planes was conducted by the Army at Ft. Bragg.

Cessna's L-19 is a high-wing, all-metal plane with 36-ft. wingspan; empty weight of 1448 lb.; maximum speed of 130 knots; cruising speed, at 29 percent power, of 90 knots; observation speed of 43 knots, and service ceiling of 22,000 ft.

F-94 LINEUP

New Lockheed interceptors receive final touches at the factory prior to delivery to the Air Force. The all-weather fighter has been assigned to guard the strategic northwest area of the U. S. Powered by an Allison turbojet with afterburner, the F-94 carries a pilot in the front seat and a radar man in the aft cockpit. A substantial number of the planes is being turned out on the same assembly lines that produced over 1500 F-80 Shooting Stars.

House Passes NACA Wind Tunnel Program

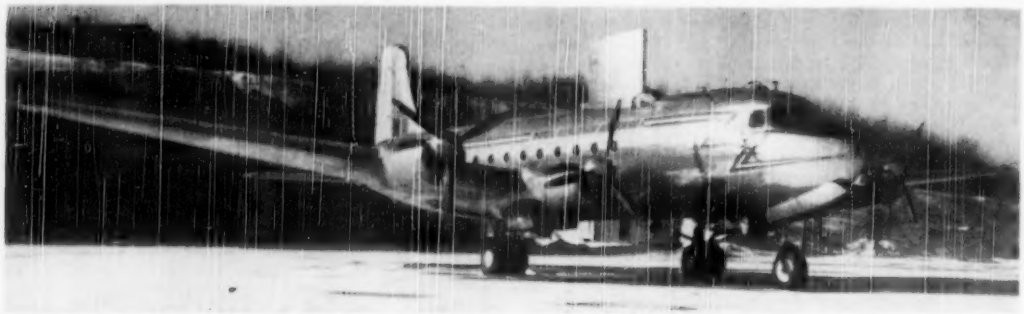
House of Representatives has given National Advisory Committee for Aeronautics a good push toward its $146,000,000 supersonic wind tunnel program. The program would provide testing facilities for aircraft and missiles "in the speed ranges from two to five times the speed of sound."

The House approved a $75 million cash appropriation to launch the program immediately in a 1950 fiscal year deficiency appropriation bill, still subject to Senate action. The President had requested only $5 million cash and $15 million contract authorization.

The House was quick to point to the urgent national defense need for high-speed wind tunnels and the fact that stepping up the program, now spaced over a seven year period, will result in a reduction of overhead and other expenses.

With $75 million cash, the House said, it will be possible to complete three large wind-tunnels which, under the seven-year program, would cost $102,244,000, as follows: An eight-foot tunnel at the Ames Laboratory, with an originally estimated cost of $32 million; a four-foot tunnel at the Langley Laboratory, originally estimated at $26,903,000; and an eight-foot tunnel at the Lewis Laboratory, originally estimated at $43,341,000. The eight-foot tunnels will go up to approximately 3.5 times the speed of sound, and the four-foot tunnel will reach a speed about five times that of sound.

The President's $20 million estimate, ignored by the House of Representatives, had apportioned $3,500,000 for university wind tunnels, $16 million for initiating construction on the eight-foot Ames tunnel, and $500,000 for design work and land purchase for the four-foot Langley tunnel.



NORTH STAR with fin growing out of its back is used for RCAF icing research. Scientists observe fin in flight, noting icing formation.

How RCAF Weather Researchers 'Break the Ice'

St. Hubert's RCAF Base, Quebec—Which is better? Electric current or hot air?

RCAF scientists have proved to their own satisfaction that for wing de-icing, and most other de-icing problems, the electric current system they have developed is a better "deal," all-around, than the "hot-wing" de-icing system now used on most modern transport and military planes.

► **Flying Ice Wagon**—Donald Fraser, leader of the RCAF cloud physics project at Rockcliffe, explained to AVIATION WEEK the new "flying ice wagon" being used in the project. The plane was on display at St. Hubert's RCAF base in Quebec, Canada.

The four-engine Rolls-Royce Merlin-powered Canadair DC4M which is specially equipped for icing flight research, doesn't look like any other DC-4M you ever saw.

It has a large square vertical fin, an extra one, about midway back on the fuselage, which gives rather a shark effect. It has transparent plastic bubbles for observers on both sides, behind the control cabin. The wings have strips of electric wiring running along the leading edges, and additional electric wiring further back in the top wing surfaces. The big fin, used for icing tests, is also wired for de-icing, as are the propellers.

Fraser said that findings of his research group had been subject of disagreement by the U. S. icing research experts at the National Advisory Committee for Aeronautics. But only recently, he added, the NACA de-icers had indicated that they were coming around to favor the electric system as well.

► **New Technique**—Technique used in electric de-icing calls for intermittent applications of current to dislodge the ice at intervals, rather than a steady flow of heat as is supplied by the hot-wing system. While electric de-icing for propellers is commonplace, the other applications are experimental.

Fraser said the ice piled near the leading edge, above and below the narrow wiring strip until the brief application of current in the wiring farther back on the wing, broke up the formation and cleared the wing. Power is supplied by means of two alternators with outboard engines as power supply. The power amounts to 60 kw.

► **Observers**—The propeller observer has a seat behind the crew on the left where he can see the propeller icing conditions, through a stroboscopic viewer, or by stopping the propellers.

A meteorological observer, usually Fraser, directs the airplane's flight in a search for the proper clouds to get icing conditions. A search-radar installation, not yet completed, will later be used to assist him in his search for clouds. He also studies ice formations on the vertical fin amidships in the fuselage.

The wing observer similarly studies wing icing formations, while an instrument observer keeps an overall check on the thermocouples and other equipment used for scientific measurements of the tests.

Fraser said that in the tests so far, the plane has experienced temperatures as low as minus 9 Centigrade, and has flown in altitudes up to 19,000 ft. The flight research tests, he said, were a sequel to earlier ground test chamber experiments which had pointed to the electric wiring system as the most suitable means of "breaking the ice."

The Rockcliffe Ice Wagon will continue its ice-seeking flights until the project group is satisfied that it has compiled a complete set of data on icing phenomena, under various atmospheric conditions.

SEC Reports Stock Transactions

Sale by Airfleet, Inc. of its total holding—100,000 common shares—in Piper Aircraft Corp. is reported in the latest Security and Exchange Commission transaction survey.

The sale of 2000 common shares by William Thomas Piper, officer and director, leaving a total holding of 146,276 shares and 9060 preferred shares was also reported.

Other aviation transactions listed for the period from mid-April to mid-May were:

• **American Airlines.**—Sale of 2000 common shares by Charles Cheston, director, leaving a holding of 400 shares.

• **Boeing Airplane Co.**—Purchase of 200 common shares by William Allen, officer and director, making a total holding of 1751; purchase of 200 common shares by Fred P. Landan, officer and director, making a total holding of 565 shares.

• **Capital Airlines Inc.**—Purchase of 4700 common shares by George Hann, director, making a total holding of 12,900 shares; purchase of 1200 common by Raymond Lochiel, director, making a total holding of 1435 shares; purchase of 1600 common by Charles Murchison, making a total holding of 6300 shares; purchase of 1000 common by Robert Wilson, making a total holding of 1036.

• **National Airlines.**—Purchase of 400 common shares by Joseph Merrick Jones, making a total holding of 5100; purchase of 1750 common total holding, by Alfred McCarthy, director; purchase of 3000 shares, total holding, by Paul R. Scott, director.

• **United Air Lines.**—Sale of 700 preferred shares by Justin Dart, director, leaving a total holding of 15,406 common shares.

New officers reported company holdings as follows:

• **Fairchild Engine and Airplane Co.** Floyd Bennett, Jr., no holdings.

• **Northrop Aircraft.**—Kenneth Bowen, no holdings.

• **Northwest Airlines.**—C. L. Stewart, no holdings.

PRODUCTION

Minimum Wage Fixed at $1.05

Labor Department decision splits difference between 95-cent industry figure and union demand of $1.15.

A minimum wage of $1.05 an hour will be required from the aircraft industry for work on most government contracts signed on or after July 8. (This wage was forecast in AVIATION WEEK Jan 9.)

Secretary of Labor Maurice J. Tobin, on recommendation of the Wage-Hour and Public Contracts Administrator, has determined $1.05 to be the "prevailing minimum wage" in aircraft for the purposes of the Walsh-Healey Public Contract Act. This law governs working conditions and minimum wages which must be paid for work on government contracts amounting to more than $10,000.

► **Minimum Doubled**—The notice more than doubles the 50-cent minimum which has prevailed legally, though not realistically, in the aircraft industry since 1938.

The definition of what products are included in the aircraft industry is also revised by the order. Last revision of product definitions occurred in 1942.

The new determination concludes proceedings begun last year when the CIO Auto Workers Union petitioned for raising the minimum. At hearings held last July, this union and two others argued that the higher rate should be $1.15, based on a survey made by the Bureau of Labor Statistics of 140 aircraft plants employing 165,000 workers, exclusive of learners and apprentices.

The Aircraft Industries Assn. opposed any new wage determination at the time because of instability of wage rates and consumer prices and the "artificially established plateau" of aircraft wage rates. It also opposed redefining the industry covered. If any wage revision had to be made, AIA suggested a minimum rate between 80 and 95 cents an hour.

► **Split the Difference**—The Tobin $1.05 rate seems to have split the difference between the top figure cited by the industry—95 cents—and the $1.15 asked by the unions. (Tobin originally decided upon a minimum wage of $1.02, but the CIO submitted new arguments which finally persuaded the secretary to add three cents to the figure he had already decided upon.)

He supports the figure from statistics in this way:

Some 115, or 82 percent, of the 140 aircraft plants surveyed by BLS employ 14,000 workers earning less than the $1.15 rate the unions wanted. These 115 plants employ 135,400 of the 165,000 employes covered in the survey. This indicates, Tobin's order points out, a "prevailing minimum wage" below $1.15.

On the other hand, more than twice as many employes covered by the survey earn between $1.05 and $1.09 as earn less than that. Half of the plants surveyed, employing more than 60 percent of the workers, have less than one percent of their employes earning under $1.05.

Some plants have no employes earning less than the higher minimum. Tobin's office says it is impossible to estimate how many workers will get wage increases under the new order or how much the increases will cost in higher wages and higher cost to the government. Not all workers in a plant fall under the higher minimum. Just those actually working on the government contract.

A lower minimum rate for apprentices was set at 75 cents. No provision was made for learners' rates. This means that learners, too, must be paid at least $1.05. Subminimum rates for handicapped workers will be set, on employer request, under regular wage-hour procedure.

The aircraft industry redefinition made clear that all electrical equipment, not just a few specified items, are excluded from the industry.

Production of castings for gun turrets and electrical accessories into castings was included in the industry, but production of electrical components themselves was excluded. Electrical manufacturers producing electrically actuated aircraft gun turrets and accessories asked that this work be excluded because it was essentially electrical.

Tobin refused to exclude aircraft gears from the industry because they are made primarily for aircraft manufacturing. But he excluded pumps and valves primarily made outside the industry which manufactures aircraft and aircraft parts.

The $1.05 rate is the same as that in the woolen and worsteds industry. Only in steel has a higher rate been set —$1.23, $1.19 and $1.08½, depending on the region.

C-W and Doman Clinch Copter Deal

Curtiss-Wright's plans to enter the helicopter field (AVIATION WEEK Jan. 30) shaped up even stronger last week when Doman Helicopters, Inc., notified its stockholders that it had concluded concrete five-year engineering service and royalty agreements with C-W.

The contracts give Curtiss-Wright the right to build and sell helicopters of more than 250 hp. incorporating the Doman-engineered rotor system. Further, C-W secures the engineering services of Doman and all present and future patent developments for the term of the agreements.

Doman is completing an eleven-place prototype Arctic rescue type copter designated LZ-4, which is expected to be test flown in about 30 days. Following initial trials, the LZ-4 design is intended for manufacture by Curtiss-Wright.

► **Doman to Up Stock Holdings**—At a special stockholders meeting, scheduled for June 5, stockholders also will be asked to ratify and approve an option of Doman to purchase 200,000 shares of capital stock at a price increasing from $2 to $6 per share over a five-year period starting Apr. 27, 1950. By gifts to the company's treasury and payments of stock to secure various services, Doman's personal holdings had declined by about 70,000 shares by the fall of 1947. Replenishment of Doman's stock ownings would guard against control passing to another group and serve as a consideration for his accepting the conditions laid down by Curtiss-Wright in the new licensing agreement.

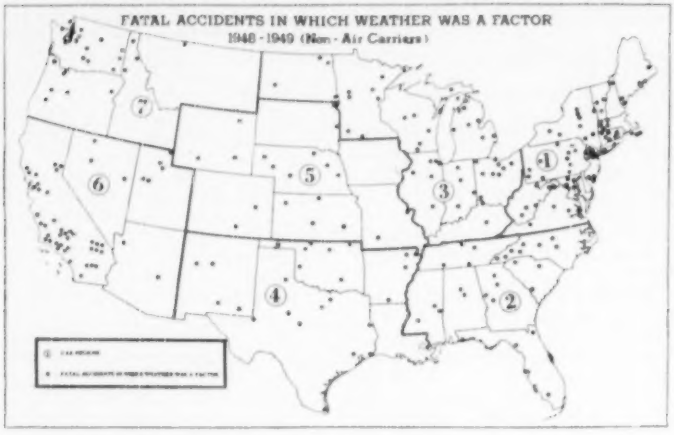
PRODUCTION BRIEFING

► **Glenn L. Martin Co.** claims savings in cost and engineering time by using inexpensive vellum instead of metal sheets to prepare lofted original drawings for its camera projection method of making tools or templates.

► **General Electric** plans to spend $1 million on altering the Taunton, Mass., plant of its plastics division. Manufacture of plastics molds to be used at Taunton and Decatur, Ill., will be consolidated at its Pittsfield, Mass., plant. Several chemical manufacturing activities will be expanded at the latter location.

► **Minneapolis-Honeywell Regulator Co.** has moved its Minneapolis air operations into a hangar sub-leased from Northwest Airlines at Wold-Chamberlain Field. The structure measures 200x150x50 ft.

SALES & SERVICE



Toll of Weather and Mountains

CAA report on non-air carrier accidents shows that pilots are still disrespectful of instrument conditions.

"Continued visual flying into instrument weather" became the laconic official obituary for 255 U. S. private pilots in 1948 and 1949.

Although fatal accidents in 1949 were 550, a 35 percent decline from 1948's 850, accidents attributed to "weather" were more numerous than in 1948, representing over one-fourth of the total fatal mishaps in 1949. "Pilot error," including weather accidents, recklessness and failure to maintain flying speed accounted for 90 percent of the fatal accidents which occurred in 1948.

This record is noted in a new report, "Fatal Accidents and Weather (Non-Air Carriers) Calendar Years 1948 and 1949," compiled by Civil Aeronautics Administration's program planning staff of the aviation statistics division.

The national average figures don't tell the whole story. The difference in rates between states was wide. During 1948 in Connecticut and New Hampshire, weather is blamed for 50 percent of all fatal accidents; the total runs to 40 percent in New Jersey, 33 percent in Maryland, North Dakota and Utah, 24 percent in Pennsylvania, 21 percent in California, New Mexico and North Carolina, and 20 percent in Massachusetts.

Mountainous areas, as might be expected, figure importantly in the accident picture. The accompanying chart, if superimposed on a topographical map, would clearly show how hazardous these areas are when visibility is low.

► **XC Factor**—Breaking the score down still further, in 38.8 percent of the cases the fatalities occurred in states other than the one in which the aircraft was registered. In fact, including accidents involving pilots operating in unfamiliar portions of their own states, perhaps half the fatal "bad weather" accidents can be pinned on planes operating in strange territory. In 19 of the 49 areas, including the District of Columbia, at least half of the weather fatalities involved planes with out-of-state registration.

Even areas boasting contact weather most of the time, such as California, Texas, Oklahoma, Utah and Nebraska, may also rank high in number of casualties. This seems to be due in some measure to owners in these states discounting the weather factor. They become lax in checking reports to make proper allowance for infrequent, though potentially dangerous, unfavorable conditions.

That too few pilots checked weather forecasts is implied in the report that flight plans were filed in only seven of the 113 fatal "weather" accidents that happened in 1948.

► **Pilot Ratings**—Those holding private pilot ratings achieved the dubious honor of being responsible for the largest number of accidents—178, or 70 percent of the total. Commercial pilots were involved in 63 mishaps (25 percent), and students trailed with 14 accidents.

The most striking statistic as regards experience is the one showing that only 1.5 percent of the 255 pilots killed in accidents attributed to weather held instrument ratings, and none of even the small number who were qualified to fly IFR had filed flight plans. None of the victims involved in 1948's 113 "weather" fatalities held instrument ratings.

BRIEFING FOR DEALERS AND DISTRIBUTORS

► **Esso Directory**—A listing of airports in 26 states is now being distributed free by Esso. Given are grades of fuel handled, class or size of the fields, and hours they are open for service. Write for the Esso Co-Pilot, Esso Standard Oil Co., 50 Rockefeller Plaza, N. Y. 20, N. Y., or any of Esso's various sales divisions.

► **Sales Plugger**—Southwest Airmotive, Dallas, is using a little cartoon cutout character "SAC Sam" to call customer attention to the firm's various maintenance services. Employes hang the cutout on customer plane dashes. Small cards describing services are inserted in a slit behind "Sam's" arm. Numerous inquiries are credited to the device by the company.

► **Hiller 360 Figures**—New performance figures for the 1950 Hiller 360 copters give the craft a normal cruising speed of 84 mph., range 210 mi., maximum rate of climb 860 fpm., and service ceiling of over 13,000 ft.

► **Hot Weather Tips**—With warmer weather bringing an increase in flying, operators are reminded to caution pilots that temperature increases affect plane takeoff runs and useful loads should be carefully calculated if the aircraft are to handle safely.

► **Operators Meet**—Operators and users of small airports throughout Tennesse are scheduled to get together in Knoxville on Aug. 19 for the Tennessee Air Progress Conference . . . The Southeastern Airport Managers Assn. is planning to hold its fall meeting in Montgomery, Ala., Oct. 10-11.

► **New Cessna Dealer**—Gleason Romans, president of Gleason Romans Aviation Service, Tulsa, Okla., has been recently appointed a Cessna dealer for a large portion of eastern Oklahoma. Romans is said to be using a new plane-financing plan that cuts the cost of excessive insurance.

The Birdmen's Perch

So—you wanna join a flying club!

That's a fine, high-type ambition! But, whether you're considering the Amalgamated Flying and Chowder Club, or the

Peerless Pilots of Ptomaine Society, check these two points carefully:

(A). Is the club an incorporated club?

(B). Does it carry adequate insurance?

In an *unincorporated* club, should one of the "tried and true" ruin a farmer's barn, *you* could be held personally responsible for damages awarded by a court against the club!

If your club fails to carry adequate insurance, one expensive accident could bankrupt the organization!

For your own protection, check the financial status of any flying outfit before becoming a member of it!

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As long as you're thinking about joining things, join the endless parade of plane-happy pilots who wouldn't consider taking off without a crankcase full of Gulfpride Aviation Oil—Series D!

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LITTLE KNOWN FACTS DEPT.

How many times have you said to yourself, "Gee, I wisht I was famous!" Well, you can be, Pal, if you'll only read and take heed!

Today we doff our hats to a spectacular citizen of the "Motor City," Mr. William R. Corliss of 20905 West Seven Mile Rd., Detroit!

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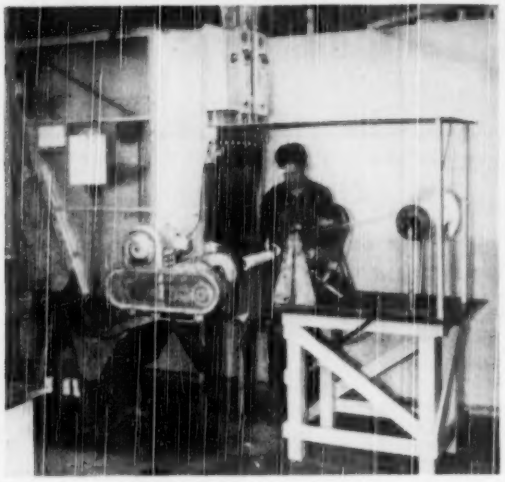


METLBONDING film machine dips 1-ft. wide strip of Nylon cloth into N2 cement, evaporates solvent with heat, redips in M3C cement and redries. Production 1 fpm.

CLEANING process for magnesium alloy requires wiping with low-flash naphtha. Primer previously applied is not softened if low-aromatic cleaner is used.

Metlbonding Saves Time, Money on B-36

New Convair adhesive development speeds production of 5500 sq. ft. of superbomber's skin assemblies.

Metlbond, developed by Consolidated Vultee Aircraft Corp., is believed to be the only adhesive used in the U. S. to join metal parts over large areas of a production airplane.

Convair's use of Metlbond has gradually expanded as the process has been improved, until at present approximately 5500 sq. ft.—more than one-fourth—of the B-36 bomber's exterior surface consist of assemblies which have been attached to stiffening members and doublers by the Metlbond process.

Yet Metlbond has not been developed to its ultimate stage. Continuing laboratory investigations are expected to result in refinements that will make it more usable and economical.

▶ **Other Users**—Metlbond has recently been made available for use of other manufacturers under Convair patents. Inquiries have been received by Convair from Boeing, Douglas, North American, Chance Vought, and Bell in the aviation field, and from General Mills, General Foods, Princeton University, Arands Optical and several other companies within the past few months. A number of these companies are currently analyzing the process and conducting tests to determine the applicability of Metlbond for various uses.

It is understood that Boeing and Douglas are farther along than the other aircraft companies in their studies of the new process and its applications.

The process is comparatively simple. Surfaces to be joined are cleaned with a solvent. They are then sprayed with a thin film of cement. This is air dried for a short time, after which adhesive in film form is placed along the faying surfaces. Pressure and heat are then applied to the areas in contact to complete the bond.

To date, Metlbond has been used primarily on clad aluminum alloy and on magnesium alloy. It is applicable also to ferrous and to other nonferrous metals, but processing methods for these have not been fully investigated. Materials which need further investigating prior to extensive use of Metlbond include unclad aluminum alloy, bare steel, plated steel, thermosetting plastics, wood, and rubber.

Most Metlbond is used on magnesium alloy sheet, where design or production improvements result. This combination of materials causes no difficulty.

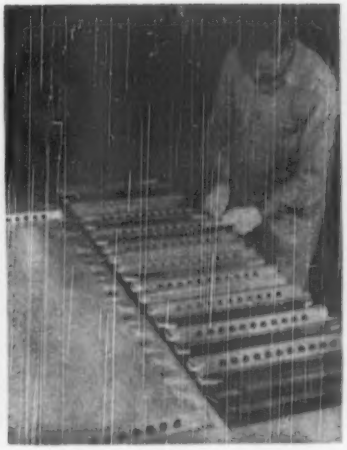
▶ **More Adaptable**—The Metlbond process has a significant advantage over most of the other high-strength metal adhesives in that it is more adaptable to production use. Cleaning methods are not unduly critical, since ordinary solvent cleaners have been found satisfactory. Application in dry film form leads to simplification. It avoids many troublesome variables which occur when adhesives are applied by brushing or spraying. Curing temperatures and pressures are relatively simple to maintain within required limits.

One of the fundamental advantages of this process is that bonds can be made at pressures below atmospheric. This permits the tooling simplification which results from employing atmospheric pressure by applying a partial vacuum under rubber blankets. Since such tools are subjected to atmospheric pressure on all sides, they do not have to be massive to prevent the deflections that would be caused by the application of mechanical pressure, which for other metal adhesives must frequently would be 100 psi. or more.

Many applications for metal adhesives like Metlbond exist in airplane construction, such as the build-up of structural members to avoid tapered machining.

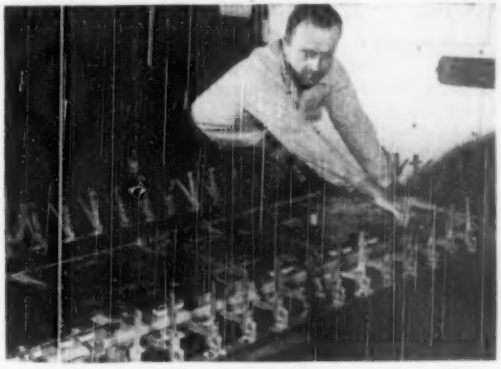
Present use of Metlbond is with thin

SPRAYING of two thin coats of M3C cement follows cleaning. Laboratory tests now being made may eventually eliminate this phase of Metlbonding.

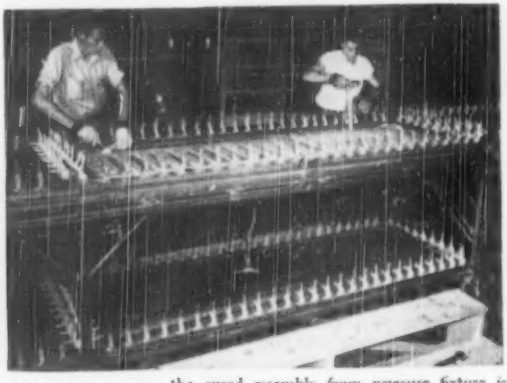


FILMING is shown being done on legs of hat-section stiffeners. Jig blocks distribute pressures uniformly on parts when rubber blanket is used.

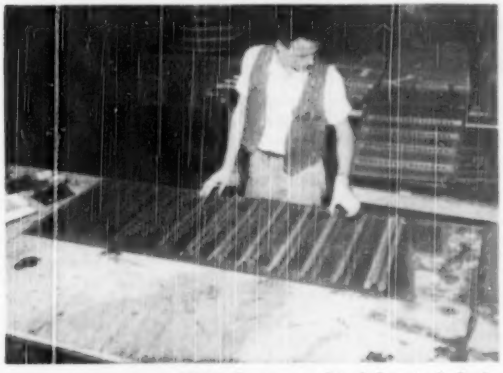
CURING oven is shown open to receive loaded fixture. Parts are blanketed, cured at 320-350 F. for 25-35 min. at low pressure.



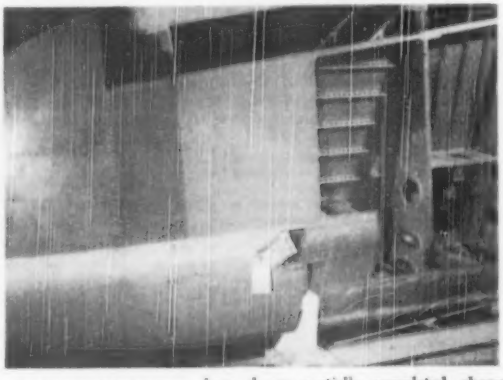
LOADING assembly in pressure fixture requires extra blocks for doubler edges. Locating jig, shown inverted here, must be flexible for uniform loading of filmed parts.



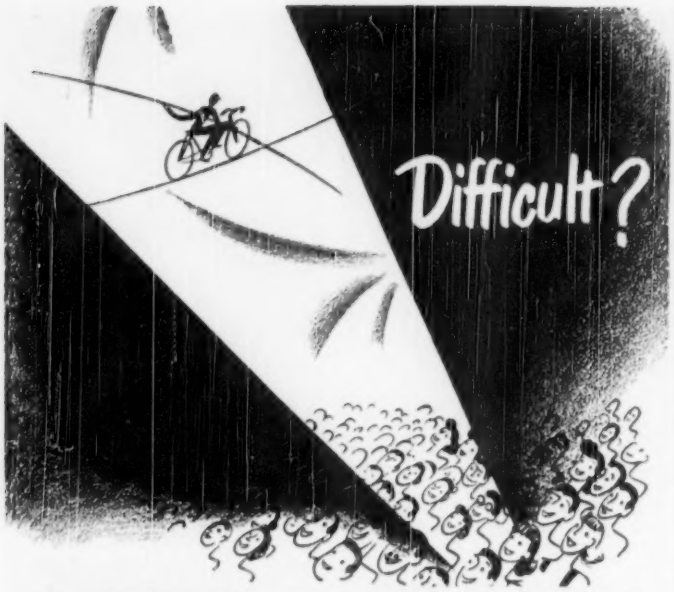
REMOVING the cured assembly from pressure fixture is quickly done, although care in handling magnesium alloys is necessary to avoid deformation due to temperature.



INSPECTING of B-36 elevator panel includes visual check for voids, delaminations or poor bonding. Magnesium alloy parts get dip coat of zinc chromate after inspection.



B-36 RUDDER, here shown partially completed, shows interior and exterior appearance of Metlbonded parts. Smooth outer surface points up aerodynamic gains from using process.



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skins, which can be attached to doublers and reinforcing members with a resulting smooth exterior surface. Any other known method of attaching such thin sheets causes surface blemishes at points of attachment.

▶ **Development History**—Convair first became interested in the use of metal adhesives for aircraft in 1941. Company engineers felt that if a satisfactory adhesive could be developed, they could simplify and improve aircraft structures and achieve better production assembly methods. Weight saving could also be accomplished by using thinner skin than when employing more conventional fastening methods.

Convair was successful in developing several metal adhesives. Two, designated M3C and N2, were outstanding. Excellent results were obtained by using a combination of these two cements.

- **MC3**, the flexible metal adhesive, establishes a bond to the metal surfaces.
- **N2**, the low-pressure adhesive, is thermoplastic prior to cure, equalizes pressures by filling small irregularities resulting from imperfectly matched parts or imperfect tools.

This combination in separate layers produces a bond which consistently develops adequate shear strength and flexibility.

After development of the adhesives came extensive lab testing to determine environmental effects, fatigue resistance, and other design properties.

For magnesium, it was necessary to develop a combination which would give good surface protection as well as a high strength. And tests of numerous combinations showed that a magnesium alloy surface, treated with Convair's anodic process, "Manodize," followed by a thin dip coat of zinc chromate primer, would meet these requirements. The shear strength was less than that obtained with clad aluminum alloy, but it was adequate for most design requirements.

▶ **Stand Up Well**—The adhesives were found to be very resistant to fungus, high humidity, and temperature changes. Laboratory tests were originally conducted at temperatures from −75 to +165 F. But planes containing Metlbonded assemblies have encountered temperatures as low as −100 F. without any apparent adverse effects on these parts.

Metlbonded joints have shown excellent resistance to the cleaning compounds used in service; and they are little affected by fuels and oils.

Fatigue resistance of the Metlbonded joints appears to be excellent, for to date none have been known to fail as a result of normally applied fatigue loads.

▶ **Technique Improvements**—Metlbond cements were originally applied by spraying to the surfaces to be joined. A

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1950

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ALCOA

ALCOA ALUMINUM and MAGNESIUM

better method has been developed which deposits cements on a thin fabric carrier, avoiding most of the spraying and all of the oven-drying operations. This dry film method of applying Metlbond cement opened up the possibility of manufacturing aircraft parts on a high-production assembly basis.

Modifications to simplify the process further are being studied. For instance, Convair engineers originally thought that the prepared Metlbond film would be damaged by exposure to elevated temperatures during shipment and storage; they also thought that the film would have to be stored in solvent vapor to prevent its complete drying.

Tests and actual usage have proved that storage of the film at a temperature of 160 deg. F. for 30 days does not affect the strength of the final bonds, when the material is used in accordance with current production procedures. Experience has also shown that if the surface of the film has dried to the extent that it will not adhere readily to areas to be bonded, it may be reactivated in a a simple manner.

Studies are now being made of the application of film directly to cleaned metal surfaces, omitting the preliminary spraying with M3C cement. Laboratory results to date appear promising. Should further investigation indicate that some of these and other improvements can be used successfully in production, further simplification of the process will result.

▶**Fatigue Strength**—B-36 elevator panel assemblies have been mounted on a test jig in a manner simulating use in the airplane and vibrated in the test laboratory. For comparative purposes, three panels were made with identical detail parts but with different methods of fabrication. One was spot welded, one riveted, and one Metlbonded.

The results of the tests were: fatigue life, with spotwelded joints, 12 million cycles; with riveted joints, 18 million cycles; with Metlbonded joints, 240 million cycles. Failure of the Metlbonded assembly did not occur as a result of fatigue in a bonded area, but by the shearing of an attaching rivet, which in turn allowed tearing of the magnesium skin.

▶**Shear Strength**—Unprimed clad aluminum alloy: Metlbond film must be capable of developing a shear stress of at least 2500 psi., in bonds to bare .064 in. clad 24S-T aluminum alloy standard panels, with ½ in. overlap. (A typical value is approximately 3000 psi.) Ultimate design shear stresses in joints between clad aluminum alloy parts are limited to 1000 psi.

Primed magnesium: Metlbond film must be capable of developing a shear stress of at least 1250 psi., in bonds to primed .064 in. Fs-1h magnesium alloy standard test panel, with ½ in. overlap. (A typical value is approximately 1700 psi.) Ultimate design shear stress in joints between primed magnesium alloy parts or between primed magnesium alloy and clad aluminum alloy parts are limited to 250 psi. at present, but this is expected to be increased to 500 psi. in the near future.

▶**Design Considerations**—When thin metal skin is indicated as a covering material and there is doubt as to its resistance to vibratory loads, the use of doublers and stiffeners attached with the Metlbond process should be considered. Satisfactory results can be achieved, however, only if good design practice is followed. Since resistance to fatigue results from the avoidance of stress concentrations, doublers of adequate thickness must be provided at all attachment points. Stiffener members should be interrupted only at reinforced points, which may be accomplished by lapping the ends over doublers.

It is of interest to note that, if stiffeners are of magnesium alloy, no joggling of details is necessary for a perfect fit. The curing temperatures used are good forming temperatures for magnesium. Joggles are automatically provided by the curing tools.

Machine countersinking for rivets or screws is permissible in thin sheet which has been built up to the required minimum thickness by the joining of additional sheet with Metlbond.

Detail parts should be kept flat, if possible. Assemblies of any shape which can be manufactured flat, and which are of a size permitted by the dimensions of the surface plate, can be fabricated with the same basic tooling. Skin assemblies for curved surfaces can sometimes be frabricated flat by using stiffeners in the direction of straight line elements.

Magnesium and aluminum alloys can be used in the same assembly. The difference in expansion coefficients is so small that warping of assemblies when cooled from curing temperatures is negligible. The Metlbond curing temperature is so high that magnesium alloy in the hard rolled condition is partially annealed. Convair reduces ultimate and yield design values to 36,000 and 24,000 psi., respectively, for FS-1h sheet in Metlbond assemblies.

Metlbond is not recommended if appreciable tension stresses exist.

A temperature of 160F. should not be exceeded while the Metlbond joint is subject to appreciable stress.

A thickness build-up of .010 to .020 in. should normally be expected in Metlbond joints.

It is not ordinarily economical to attach small items to a small area of a large assembly with the Metlbond process. It is not worth while to carry large

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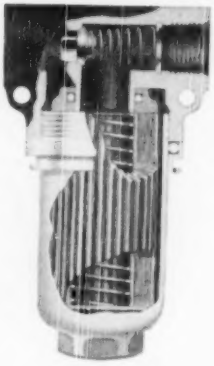

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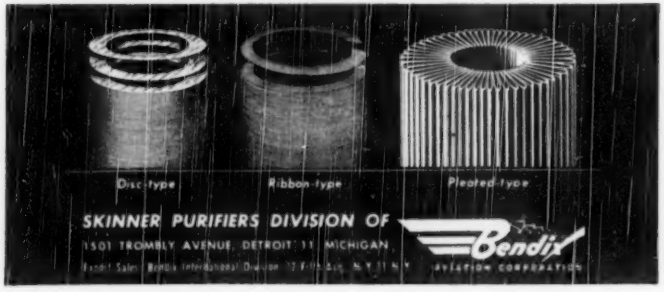

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parts through the required processing unless Metlbond is used rather extensively on the assembly.

Undoubtedly as the new art of joining structures with Metlbond and other metal adhesives becomes more familiar to designers, they will take advantage of its proven worth, and radical changes in some types of aircraft structure may be expected. Such structure may show a marked decrease in the number of component parts required. Lower cost production of airframes with high-production assembly methods, and longer service life with less maintenance expense may be expected.

Tool Life Tripled By Special Process

A method of greatly increasing the life of high-speed cutting tools reportedly has been developed by Sol-ven-ite Laboratories.

The process is called Solveniting. It is used only with tools made of high-speed steel that are already hardened, tempered and finished to size. According to the firm, tool life is increased by changing the characteristics of the steel to a "reasonable depth" to attain the qualities desired.

The company says this metallurgical treating process does not bring about any dimensional changes, distortion or warpage of even the thinnest sections. There is no after-treating grinding. Under the present arrangement, tools are sent directly to Sol-ven-ite, treated there, and then returned to user. The organization is set up for 24-hr. service.

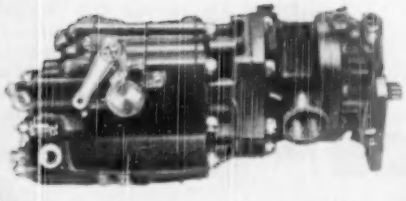
It charges $1/lb. for treating standard high-speed tools and 35¢ per unit for tools weighing ½ lb. or less. There is a minimum charge on all work of $3.

The firm guarantees a 50 percent increase in life of any high-speed cutting tool, but says several companies—Allison division of General Motors Corp. is one—report increases of 300-400 percent.

A Sol-ven-ite executive told AVIATION WEEK: "We can confidently guarantee our customers they will save thousands of dollars with our process, offering them less machine down time, increased production and a smaller inventory of high-speed tools. So far as we know, there is no other process like ours."

The firm is inviting interested companies to send a tool that is currently in use, or whose past production record known. It will be treated and returned. If the user is not satisfied after 30 days, no charge will be made. Sol-ven-ite says the process is the result of eight years of research and has been exhaustively proven. Address: Solvenite Laboratories, 3928 Elston Avenue, Chicago 18, Ill.

Chance-Vought's new NAVY F7U is powered by the WESTINGHOUSE J-34 Jet Engine. Turbine Control by HOLLEY.



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FOR HALF A CENTURY—ORIGINAL EQUIPMENT MANUFACTURERS FOR THE AUTOMOTIVE INDUSTRY

Data from British Ignition Forum

International experts discuss plug design, lead content, moisture effects, low vs. high tension, analyzers.

(McGraw-Hill World News)

London—The thorny problems of aircraft ignition systems were studied in a recent two-day conference sponsored here by Lodge Plugs Ltd., Rugby. Attending were about 50 representatives of 15 airlines operating into Europe, and manufacturers of sparkplugs, ignition systems, and aviation fuel, and members of government departments (AVIATION WEEK, May 22).

The conference, first of its kind to be held in Europe, was modeled in a general way after the Champion conference held in the U. S. last September. F. R. Banks, of The Associated Ethyl Company Ltd., presided.

The sessions were marked by a splendidly frank give-and-take between the operators and the manufacturers and revealed many deep seated grievances. The meat of the conference was to be found in these exchanges. This is the first comprehensive report of the conference to be published.

Sparkplug Design

The conference seemed to agree that plugs should be designed for "no maintenance," or, at the least, should be good for the life of the engine-overhaul cycle without attention.

It was pointed out that ignition servicing required by far the major share of all engine-servicing time. Most of the carriers' representatives lay a good part of the blame on the plugs.

KLM's Mr. Lam indicated that he really would prefer to do no maintenance on plugs whatever, if he could get a 300- or 400-hour "expendable" plug at the right price.

► **Expendable Plug**—Lodge Plugs, according to Mr. Bernard Hopps, its technical director, is working on the possibility of an expendable plug (to have a 400-hour life) with the manufacturer carrying out the recovery of platinum from scrapped plugs returned by the user for credit. (Lodge has recovered the metal from 16,000 plugs sent back after use by KLM.)

Mr. Hopps thought the whole idea of expendable plugs would be unnecessary if plugs were properly cleaned. This means that they must be designed so that they could be properly cleaned.

Trans-Canada Air Lines' R. W. Farren suggested that consistent performance was more attractive to him. Thus engine maintenance as a whole could be better controlled and efficiently planned. He'd settle for a plug good for one complete engine-life without maintenance. A 300-hour plug, he felt, was not good enough—he wanted a plug to "fit and forget."

It did not appear likely to him that a plug that would be fully dependable for the life of the engine period could be obtained while using the high-tension ignition system because of gap-erosion.

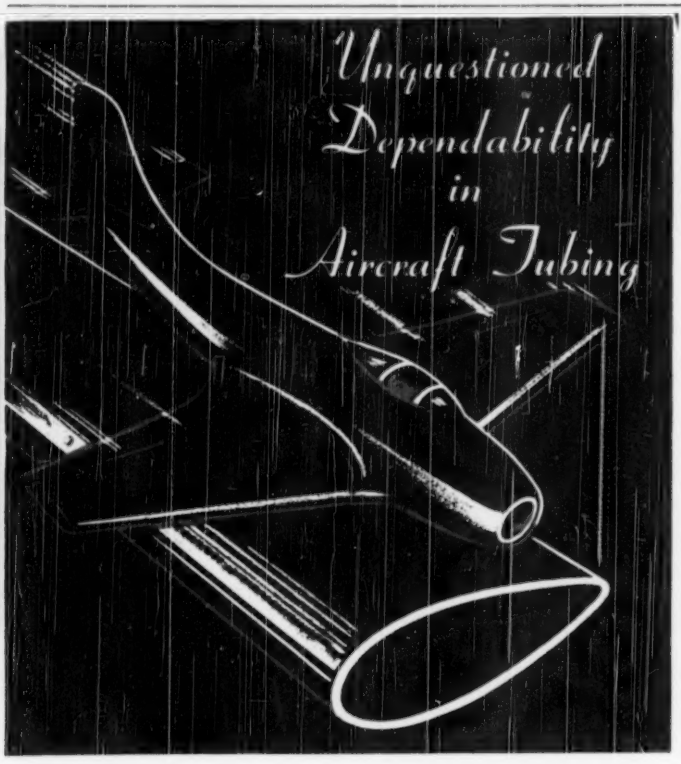
Hopps traced present trends in the design of plugs to increase their life and to prevent premature failures. These developments lay in three fields:

- **Design of the insulator** and tip-cavity to discourage lead-fouling;
- **Fine-wire** vs. heavy metal electrodes;
- **Making water-tight** the electrical connection.

► **Foul Tip**—He felt that the Lodge RS19/2R plug (standard on almost all European airlines in whose powerplants it is applicable) represented just about the limit of what the plug manufacturer could provide to resist lead-fouling.

Its greater clearance between insulator and body provided the maximum

(Continued on page 33)



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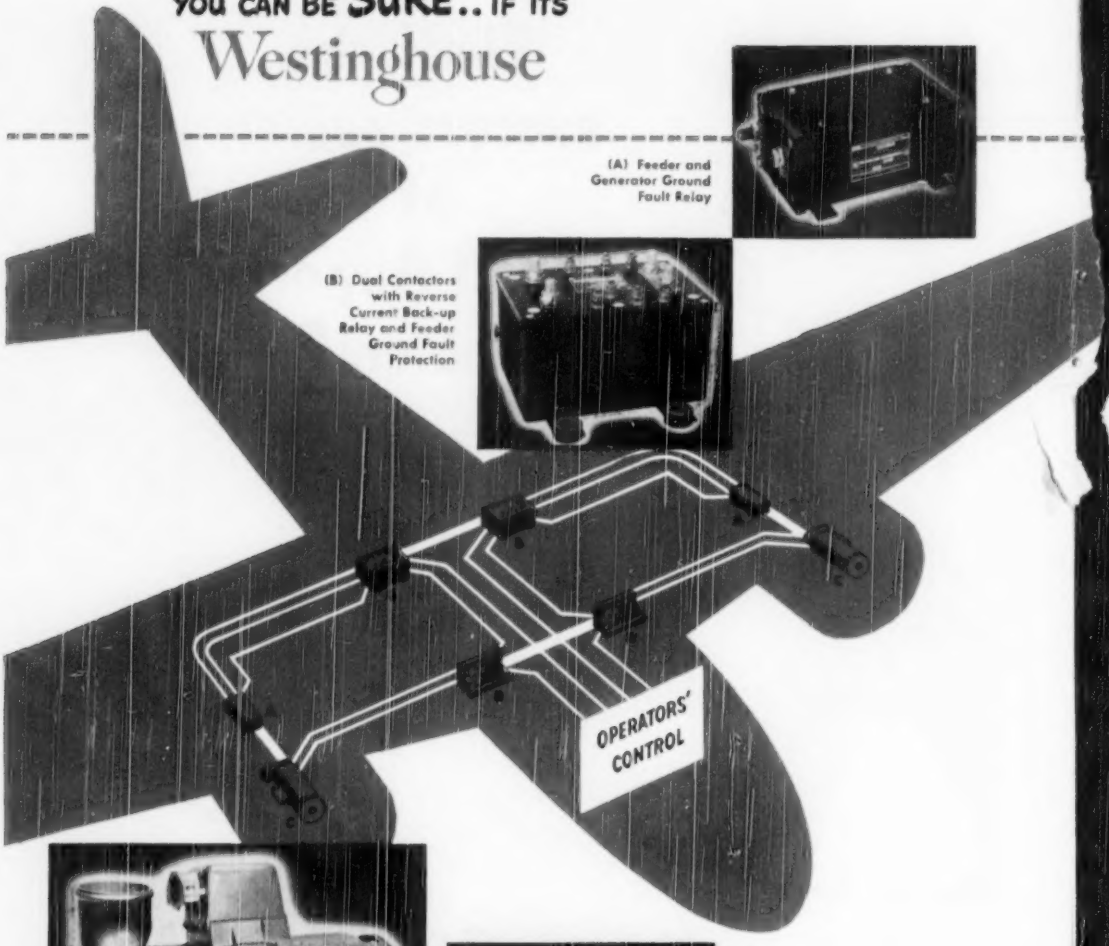
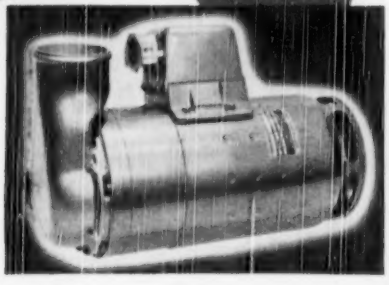
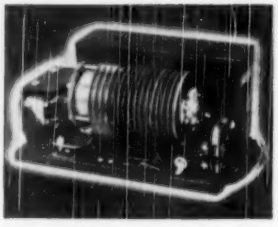




(C) Buttonhole Quick Disconnect Generator



(D) Centralized Plug-in Control Panel

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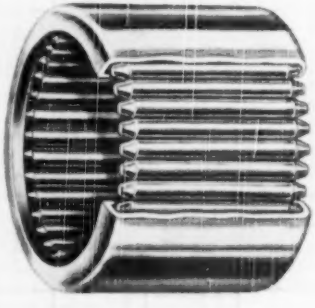

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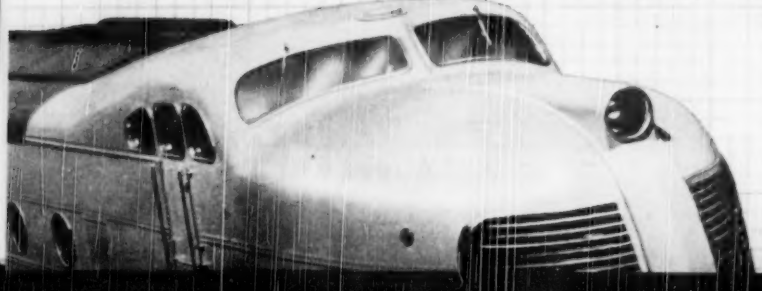

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opportunity for scavenging action and also for the penetration and swirling action of the sand, in sandblast cleaning; its short nose meant a lower nose-temperature gradient and hence less likelihood of cracking. From here, he said, prevention of lead-fouling was up to the engine manufacturer (to provide better circulation in the cylinder-head, and thus better mixture distribution) and the fuel manufacturer (to reduce the lead content of the fuel).

Hopps said lead-fouling may be more common on carriers in the Eastern Hemisphere than on U. S. airlines since U. S. aviation fuel is lower in lead-content (3.5 cc. per Imperial gallon, and not exceeding 3.6 cc. whereas many British planes have to use fuel with as much as 4.8 cc. per Imperial gallon). U. S. aircraft are generally operated on richer mixtures. This lessens gap-erosion.

As to the electrode material, Hopps reported that since the U. S. carriers had had no experience with the latest designs of British plugs, using platinum electrodes—American engine manufacturers had not approved them fully for use—the Americans still thought that nickel-alloy points gave performance comparable to the best in the world.

P. A. Young, of Wright Aeronautical, replied to Hopps' chiding of the American engine-manufacturer, reminding the group that the engine builders had approved the Lodge plugs for service-test installation, but that so far no American operator has been interested in running extensive service life tests of these plugs. His company, he said, would welcome such test evidence—but would want to see the tests run on at least a 500-plug installation basis, and carried on for 500 to 600 hours of operation.

► **Fine Wires**—Martin Graham, of Pratt & Whitney, said that with fine-wire electrodes there is no danger of pre-ignition, and if fracture occurs the fragments fall away and there is no possibility of detonation.

TCA's Farren reported that from service tests he knew of, fine-wired plugs on Pratt & Whitney 1830s in DC-3s hadn't worked out so well, and plug-troubles had been pretty high. By contrast Champion solid-electrode plugs were now giving 940-hr. service life when serviced regularly at 250-hr. intervals.

F. M. Savers of Lodge Plugs felt that what airline engineers want is the performance of platinum wire while retaining the heavy mass of the solid electrodes. He thought a combination of metals might do this.

Rolls Royce's H. E. West suggested that he would like to see an entirely different insulator shape—an "inverted" one—so that the lead deposited on the insulator will not run down to the tip of the positive electrode when molten as in the conventional inverted-pear insulation shape. (Lodge is studying such a design at the moment.)

As to water-tightness, Hopps felt that a design (such as developed in the U. S.) where the rubber hose butts against the shoulder of the screen tube, should give satisfactory performance.

Cleaning and Maintenance

Granting that some cleaning of plugs must be carried out, the relative merits of sandblasting and liquid-cleaning were discussed.

Mr. Lam (despite his desire to do no plug-cleaning watever) reported that KLM's experience with cleaning showed that overhauled plugs gave only 2% more failures than new plugs. This, he felt, showed that his airline had developed pretty good methods for detecting a failing plug during overhaul—particularly in detecting cracked noses. But for the most part, he admitted, "we don't really know much about what causes sparkplug failures." Research on a few plugs didn't give sufficient information, he said: an operator must study a large number of plugs—both in service and after removal—in order for the averages to mean anything.

Lam commented that the only proper method of cleaning a plug was to take it apart and sandblast it. But, on practical grounds, he preferred to leave the plug assembled, sandblast it for ½ min. and not be overly concerned if a little lead was left in the cavity.

Farren pointed out that sandblasting was likely to leave pits where lead deposits might be encouraged, thus leading to tracking failures. He urged liquid cleaning, since (in his experience) a sandblasted plug was likely to vary in useful life from 5% below that of a new plug (in its second life) to 30% below (in its third life). He admitted that these differences might be due to any of several causes, and not just to the fact that the plug had been sandblasted clean.

► **Coming Clean**—Mr. Farren described the liquid cleaning method adopted by Northwest Airlines. This involves washing the plugs for as long as an hour and a half in a bath of potassium hydroxide at 400 deg. F. The method makes use of a special revolving drum. On its inner surface bosses are fitted to which are screwed the plugs, so only the ignition-portion of the plug is immersed in the bath, which is constantly agitated during the cleaning. Complete cleaning can be done, or partial cleaning followed by sandblasting for a shorter time than would otherwise be called for.

G. H. Fletcher, of the Royal Aircraft Establishment, Farnborough, mentioned that the RAF has used ammonium acetate—with the addition of Teepol, a chemical wetting agent—in a non-agitated bath at atmospheric temperature, with some success, reducing the amount of subsequent sandblasting needed.

Hopps of Lodge Plugs had mentioned in the course of his paper on sparkplug design that the shape of the insulator and surrounding cavity in American plugs was less favorable for sandblasting than in Lodge plugs. He felt that American operators hadn't really given sandblasting-cleaning a fair chance. He disagreed with Farren's remarks that sandblasting left pits in which lead would be deposited: the duration of the blast is so short that the ceramic of the insulator is not seriously affected and certainly its lead-retaining characteristic is not increased thereby. H. E. West of Rolls-Royce concurred with Mr. Hopps on this point.

► **Hot Test**—Farren urged that some device be developed for testing plugs, especially after they have been overhauled. Such a device would have to simulate the high temperatures encountered in service—since a plug might run quite satisfactorily cold but fail after it had been reinstalled in the engine.

Lam described the methods followed by KLM for testing:

- **Use of a gas stream** directed at the ceramic. This takes two hours to heat up a whole engine's array of plugs properly.
- **High-frequency** radio waves used for heating the plugs.

Both methods were so slow and so costly, he said, that it gave additional force to his conviction that he would cheerfully adopt a no-overhaul basis for plugs, provided he could get plugs that would last the life of the engine-cycle.

Lead Content of Fuel

The problem of lead-fouling was probably the one uppermost in the minds of most of those attending the conference.

J. G. Dawson, of Shell Petroleum's Thornton Research Center, discussed how fuel composition affected sparkplug performance. In the main, he recapitulated the treatment of the same subject at last September's conference—showing how the deposit of lead salts and metallic lead on the insulator lowers the potential difference across the spark gap so that the sparking current is reduced to a point where it is insufficient to produce an arc across the gap. It is this shunt-resistance effect which is the main source of trouble from lead-fouling, he said; gap-bridging is a minor trouble.

In dealing with lead-fouling, he said, effective scouring by the cylinder gases should be encouraged in every way; this will not necessarily prevent the deposit of lead, but it will assist in dissipating

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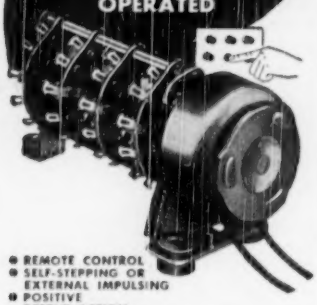

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the lead when it is deposited.

Dawson cited the graphs prepared by Droegemueller of Pratt & Whitney as giving the most relevant data on correlating the amount of lead content in the fuel with the occurrence of lead-fouling. But the bulk of this data was obtained from engines on a laboratory test bed, and the two sets of data based on actual airline experience gave an entirely different slope to the curve. And the tests were carried out with a plug known to be particularly susceptible to lead-fouling.

► **More Pay, Less Lead**—The Associated Ethyl Corp.'s viewpoint was presented by F. R. Banks, the conference chairman. According to Mr. Banks, "you can have less lead in your aviation gasoline if you don't mind paying more for the fuel." In support of a lower lead-content, he said the Stratocruisers run a little better on 108-135 fuel than on 115-145.

O. L. Bass, of Shell, indicated that the trend in the amount of lead-content in 108-135 fuel for European users is likely to be downward during the next 18 months—toward 3.6 cc. per Imperial gallon. For the 115-145 fuel, however, the lead content is likely to remain constant for a while.

While a considerable reduction in lead content might be desirable, Dawson said it was generally regarded that only a small reduction would be possible. Similarly, a major reduction in the sulphur and bromide content would not be possible.

► **Scavenger Hunt**—Unequal distribution of the lead in the cylinders—unless some provision is made in the manifold design to prevent it—results in an unequal distribution of the need for a scavenger.

One of the most suitable scavengers thus far found is acetylene tetrabromide, which, having the same volatility as the lead, distributes itself throughout the engine in the same relative proportions as the lead.

Banks had this to say about the hunt for scavengers: "We've been looking for the right material, but we just haven't got it yet." He mentioned that most scavenger research had been carried out on in-line engines, and the difficulty was that if the scavenger was any good as a scavenger, it was so chemically unstable that it wouldn't store—it would "grab off the lead before the fuel was used."

The economics of production enter into it too he said. Only when research turns up a scavenger that is suitable for all types of fuel—or at least a large enough portion of them—will it be economical to produce in quantity.

Engine Analyzers

The new British Thomson-Houston analyzer, designed primarily for ground-testing ignition system performance, was described by D. F. Welch. This unit, by means of trace-expanders, gives a magnified view of just what goes on in each cylinder at the moment of sparking. By comparison with known "normal" traces, the mechanic can diagnose what is wrong.

The British Thomson-Houston unit is not as versatile as the Sperry analyzer in the breadth of information it can present, but it offers a useful instrument within its limitations.

Several members commented that while the high-tension "signals" might become quite familiar and the nature of the faults thus shown up quickly diagnosed, patterns from a low-tension system would be much less distinctive and the diagnosis more difficult. More intensive training of the mechanics to recognize the faults in low-tension systems would be required. Rolls-Royce's H-E West commented that the B-T-H equipment didn't distinguish sufficiently the nature of the fault and its location.

TCA's Farren reported that Pan American's fact-finding with the airborne Sperry analyzer had revolutionized the airline's maintenance and inspection routines—so precise was the information as to trouble-spots which the flight engineer could provide. This extended beyond engine performance, to include propeller stresses, fuel-warming equipment, etc.

KLM's Lam said that his line was only just beginning to study ignition systems with the Sperry analyzer on the test bed, but that already it had helped point out magneto trouble or bad connections in the distributor.

Low vs. High Tension

KLM's Lam reported that his line had logged considerable time on the low-tension ignition system fitted to the Wright BD-1 engines on the 749 Constellations. Experience showed longer plug life and less radio interference. A small amount of testing of the low-tension system in P&W R-2800 engines on DC-6s also showed increased plug life—up from 200 hours to 400 hours. As a result, KLM has decided to equip all its DC-6s with low-tension ignition systems.

KLM will next try out the General Electric high-frequency (low voltage) system on its Convairs in about three months Lam indicated. He feared that his mechanics – being motor-cycle minded, as he put it—will probably be disposed to tinker with the adjustable distributor finger, rather than make the proper adjustments to the breaker-points. He hoped that the use of the engine analyzer (on the test bed) plus the switch to the high-frequency system would solve 60% of his engine troubles.

► **Long Life**—TCA's Farren disclosed

Photo courtesy of Douglas Aircraft Co., Long Beach.

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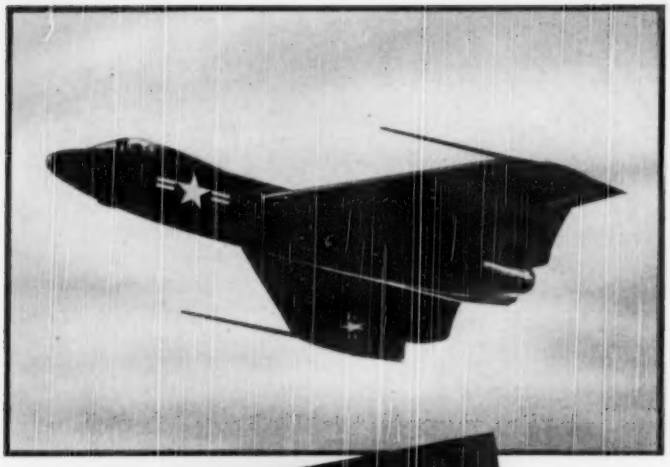

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the results of tests by Pan American which appeared to confirm that the Bendix-Scintilla low-tension system on P&W R-2800 engines had definitely confirmed the claim of longer plug life. Life up to 800 hr. before inspection had been achieved, using a special Champion HL 15 plug. The plugs were then reinstalled and run for as long as 1200 hr.

Erosion rate shown in these tests averaged not more than .001 in. per 100 hr. Hence, with a gap-setting of .015 and a limit of erosion of .025, this would give a possible plug-life of around 2000 hours.

Farren said the low-tension magneto does not inherently overcome lead-fouling, but that the high-frequency system does. Welch of B-T-H commented that the high-frequency system increases the altitude at which the plane can fly, with a larger gap.

▶**Low Tension, Low Weight**—Rotax Ltd., according to one of its representatives, is backing the medium-frequency low-tension system (2 kv., 250 volts).

Scintilla Ltd.'s Mr. O'Brien added that there is a weight-saving advantage in the low-tension equipment. The unit weighs 85 lb., a saving of about 12 lb. over a single high-tension unit, and nearly 120 lb. over the usual multiple unit.

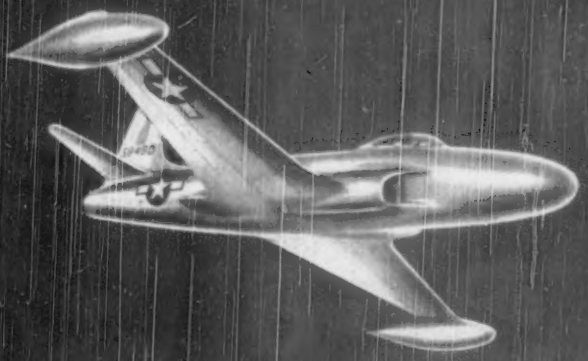
Bristol Aeroplane's T. F. Batchelor said his company had had wholly satisfactory results from stationary testing of the low-tension system installed on the Hercules engines powering the new Hermes IV transports for BOAC. The equipment successfully went through both the 150-hr. test for certification and the 800-hr. type test.

Moisture

Considerable discussion of the problem of moisture-condensation in the ignition "harness" showed great differences of opinion as to whether or not this was an important source of ignition failures.

Representatives of BOAC reported that on the Far East route, where ten flying boats have been operated until just recently, it was a common occurrence to drain an egg-cup full of water out of each electrical lead. G. R. Shaw, of BOAC's Far Eastern line, said he was convinced that this condensation was due to the cooling down of the engines while on the water, in conditions of 100% humidity, and that the water did not find its way into the leads from spray on takeoff. The airline thought this was probably their worst source of ignition trouble, since it caused a complete loss of spark.

But Shaw admitted that their records were unconvincing as to the actual cause of failures of the ignition system.



Every Lockheed jet in service

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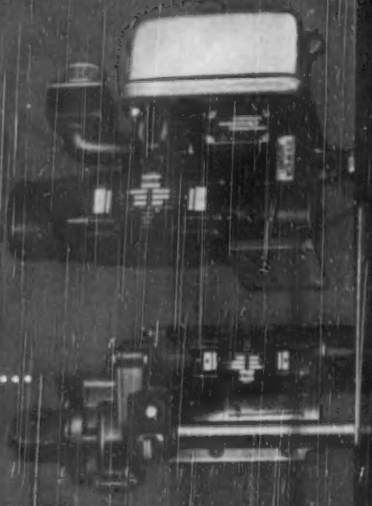
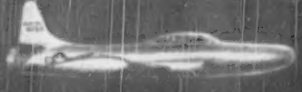
LEAR linear actuators...



and LEAR screw jacks...

to actuate wing flaps,

aileron trim tabs, and rudder trim tabs



Every jet aircraft built by Lockheed in production, whether it be the F-80, the T-33, the F-94, or the F-104, is equipped with LEAR electro-mechanical systems. Like Lockheed, many other aircraft manufacturers who know the value of experience, service and proven dependability, have found that it pays to standardize on Lear.

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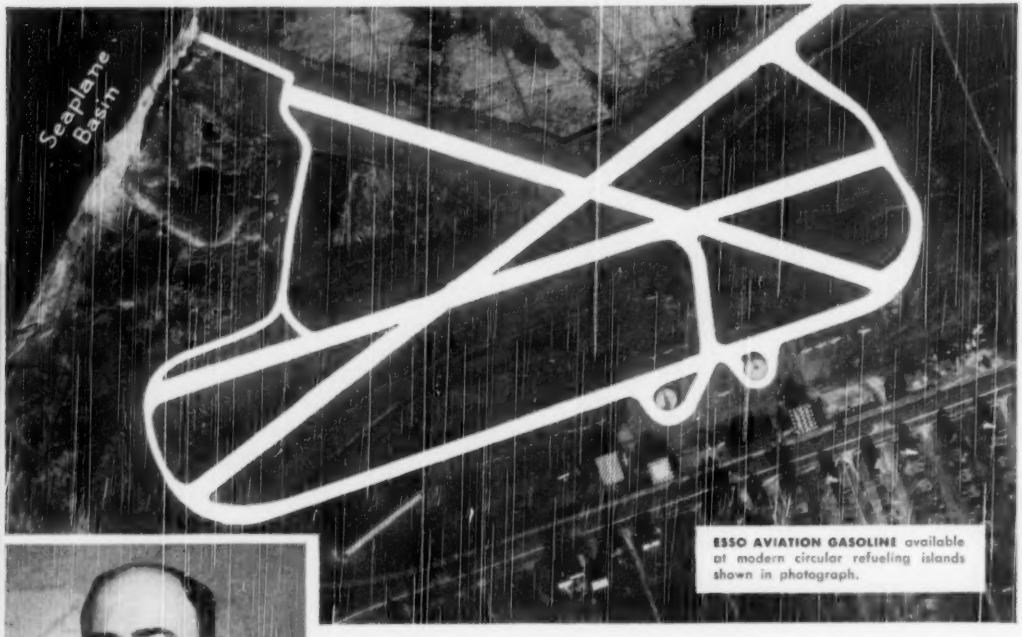

ESSO AVIATION GASOLINE available at modern circular refueling islands shown in photograph.

JULIUS GOLDMAN, President and General Manager, Revere Airways, Inc., which own and operate Boston-Revere Airport. He is a member of NAA, QB, AFA, and Kiwanis.

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AVIATION PRODUCTS

since, in the pressure to get the engine running again, the carrier's mechanics would commonly change the plugs first—as being the easiest thing to do and most likely to get the desired result. Hence, the figures wouldn't always reflect the real cause of the failure.

To keep the condensation out of the plug itself, BOAC has devised a rubber grommet to fit into the top of the screen tube.

To solve the condensation problem, BOAC has tried, with success, controlled ventilation of the "harness," through a silica gel absorber.

TCA's Farren said as long as the water could be kept out of the barrel of the plug there was no need whatever to worry about condensation in the harness.

On the other hand, Rolls-Royce's West felt that harness condensation can truly be regarded as a cause of plug failure: Condensation could lead to misfiring, this would cool down one plug in comparison to the others resulting in the building up on that plug of lead deposit and eventually causing the plug to crack.

Air Commodore A. F. Hutton, RAF, commented that harness condensation is still a problem—citing especially the RAF's recent experiences in Malaya—but might be due in large part to the fact that the RAF was still using wartime materials. He thought controlled-ventilation offered the solution.

► **To Be Published**—Lodge Plugs plans to make available a complete transcript of the two-day ignition meeting as soon as the verbatim report has been edited.

Tunnel Uses Steam

Steam instead of air is being used in a model tunnel at Pratt Institute, Brooklyn, N. Y., to eliminate the need for an expensive electric powerplant and compressor system.

Developed under the direction of the engineering school's Major James R. Randolph, the facility is connected to the Institute's 115 psi. steam lines. Size of the test section is 5 sq. in., nozzle throat area is 3.58 sq. in.

According to Randolph, steam pressure is reduced to 5 psi. at the nozzle, the temperature value being about 285 F. Passing through the nozzle, pressure drops to about 1.2 psi. giving a temperature of 108 F. Speed at this point is equivalent to M = 1.564, it is claimed.

No fogging is reported, except at start-up.

One experiment contemplated is to use steam at a little below the saturation point to avoid the use of schlieren. This means, Randolph says, that the steam would be cloudy on one side of the shock wave, clear on the other side.

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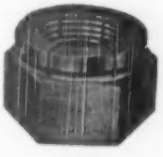

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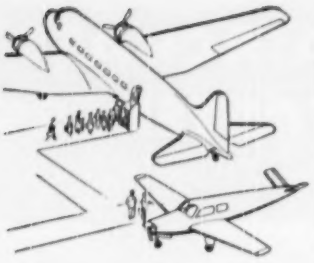

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FINANCIAL

CAB Asks Airline Securities Role

Agency seeks power to regulate carriers' financial structures; lines oppose this extension of control.

The Civil Aeronautics Board is again making a strong bid for jurisdiction over issuance of airline securities. The Board contends that, for effective discharge of its duties, it should have power to regulate capital structures of air carriers. The industry is maintaining its stand opposing this additional grant of power to the CAB.

The airlines, like all industry, resist all extensions of government controls and what might be considered undue interference with private enterprise. But the carriers are endowed with a public interest and enjoy a franchise which provides them with a degree of monopoly. And financial assistance is afforded the industry through subsidy mail payments and other forms of government support.

The need for security controls has been clearly established and accepted in other regulated industries. The Interstate Commerce Commission and the Federal Power Commission have such power with respect to the public utilities under their respective jurisdictions.

▶ **Precedent Cited**—The existence of such controls in other regulated industries is cited regularly by the CAB as precedent for granting similar authority over airline finances. In its current attempt for such powers, the Board maintains that certain airlines "failed to take advantage of the favorable equity market which occurred during and immediately following the war" and increased their debt too heavily.

The airline position, heartily concurred in by the financial community, is to the effect that the CAB is inherently ill-equipped to promote the public interest in problems of airline finance.

There can be no question that an over-all view of the regulatory processes is essential to determine the place, if any, of jurisdiction over airline finances. Impartial observers may question whether the CAB could have developed sound capital structures among air carriers if it had power to pass over issuance of securities. Some may point to over-duplication of the current route pattern and to the fact that the Board may have shared industry optimism in making awards which today provide wasteful competition and the necessity of heavy subsidy payments.

▶ **Cross-Purposes**—There is much that the CAB can do today in controlling airline capital structures without the grant of any additional powers. But such elements of control frequently appear to operate at cross-purposes.

A prime example is present in the Board's relationship with the Reconstruction Finance Corp. in sanctioning government loans to air carriers. Under the law, the CAB is required to certify to the RFC that the applicant can discharge its obligations without benefit of a judicial reorganization before RFC can make the loan. This requirement has created a series of paradoxical situations.

In its annual requests for control over airline securities, CAB has persistently alleged that it would have discouraged heavy debt structures but would have promoted more equity issues in the industry. Yet, the Board has not only acted contrary to its own professed admonitions but allowed itself to be placed in a tight corner in the case of Northwest Airlines.

▶ **Look at NWA**—In this particular instance, there are a series of conflicts in policy. In its decision of April 19, 1949 in which trans-Atlantic mail awards were made to Pan American and American Overseas Airlines, the Board issued its "blank check" manifesto. Believing that these carriers might be acquiring excess capacity in the Boeing Stratocruisers, the Board warned that "Section 406(b) of the Civil Aeronautics Act is not a blank check which airline management may fill in for any amount which it finds necessary to support whatever quantity or type of service which that management may see fit to operate."

A few months later, CAB sanctioned an RFC-guaranteed credit of $21 million to Northwest so that the carrier could fulfill its obligations in acquiring 10 Stratocruisers. Yet the question of excess capacity is far more obvious on Northwest's Orient route than in the service of Pan American or AOA.

While the majority decision of the Board approving the RFC credit asserted that it was not underwriting later actions of the Northwest management concerning the aircraft involved, such philosophy may soon be placed to a serious test.

Focusing directly on the CAB-approved Northwest capital structure (by

its certification to the RFC), it is apparent that the carrier's debt is far too top-heavy in relation to its existing equity position. Almost similar circumstances pertaining to TWA's heavy debt structure led a CAB member to declare last year that if the Board had the power it would have told them "they had to have a different kind of capital structure."

It is ironical that in its approving actions on the Northwest RFC-guaranteed credits, the Board has far from solved that carrier's basic problems. If anything, it has compounded a series of errors which will continue to be troublesome until corrective action—which should have been taken in the first place—is finally effected.

►**Time Lag**—The Board's case for control over securities issued by the airlines may also suffer from the time-consuming delays which have been present in various route and mail rate proceedings. In any marketing of securities, timing is of great importance. Market fluctuations can develop almost overnight upsetting the best-conceived financing program. If such financing proposals had to await clearance by the CAB in the same manner in which route matters are determined, the air carriers would find it extremely difficult to market securities to good advantage.

These delays in route proceedings are costly in themselves and have an ultimate bearing on the make-up of capital structures.

For example, in the pending Hawaiian case, a number of carriers are very much concerned as to the ultimate decision pertaining to the Los Angeles-Honolulu route award. Large investments remain immobile on the part of the carriers involved until this final determination is made. This factor alone frequently serves to discourage investor support of the airlines.

The question of jurisdiction over airline finances is merely one phase of the over-all industry picture. It is not paramount to creating stability in the group.

All efforts must first be devoted to develop consistent earning power. This may well call for drastic route re-allocations and the elimination of excess competition within the industry. Heavy subsidy payments do not add to any airline's credit standing. Earnings which are largely attributed to this source are very suspect among investors. On the other hand, earning power generated by a company's own efforts invariably receive a much higher market valuation.

With restored and sustained earning power, an air carrier has much greater flexibility in arranging such financing as best suits its needs—and it will make little difference in the final analysis which government agency has jurisdiction under such conditions.

—Selig Altschul

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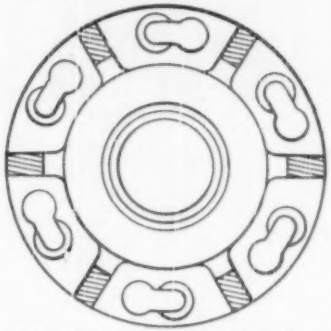
Mounting Bracket Is Big Timesaver

Westinghouse's new 'buttonhole' bracket saves an hour in generator mounting; other aircraft uses seen.

Up to an hour's saving in generator mounting time has been realized at Wright Field by use of a new, "buttonhole" mounting bracket recently patented by the Westinghouse Electric Corp., East Pittsburgh, Pa.

The same principle may be applied to the growing number of engine-driven accessories, although the only reported use of the bracket is for generator mounting.



DRAWING of patented Westinghouse generator mounting bracket showing elongated arc-shaped attachment holes.

Since as many as nine accessories are mounted on today's aircraft engines, more than a whole work day could be saved were all accessories equipped with this unit, according to some estimates. This presages an impressive potential man-hour saving during engine tear-down and build-up or accession replacement, as well as reduced ground delays caused by accessory failure.

Wright-Patterson AFB claims a saving of 50-60 minutes in mounting AN-3633 300-amp. generators on B-50Ds.

▶ **New Twist**—Principal features of the bracket are the elongated, arc-shaped openings, one end enlarged to permit the hold-down nut to pass through. By allowing the nut to be installed on the engine pad studs prior to mounting the generator, a considerable shortening of the mounting bracket proper is accomplished. This serves a threefold purpose:

• **Moves the generator** center of gravity as close as possible to the mounting pad, resulting in a reduction in the magnitude of alternating stresses set up in the generator by engine vibration. Many generator failures have been ascribed to excessive vibration.

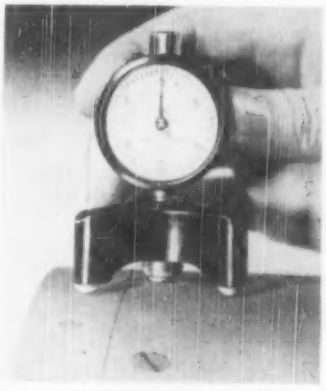
• **Reduces overhang moment** on the engine rear case and generator pad.

• **Provides more space** in the congested engine accessory compartment.

The time-saving element is derived from the fact that the nuts can be installed on the studs before mounting the generator, when they are readily accessible. The nuts are threaded on the studs far enough to leave just sufficient clearance between the nut and the pad for the flange portion of the bracket. After installation, the only operation remaining is to rotate the generator so that the nuts coincide with the specially provided, counterbored seats and tighten the latter.

The rim and flange portions of the bracket are joined by longitudinal reinforcement ribs which provide strength and rigidity in the direction of the vibratory stresses to which the unit is subjected, while keeping the weight low. Ample space is provided to make the nuts accessible.

NEW PRODUCTS DIGEST

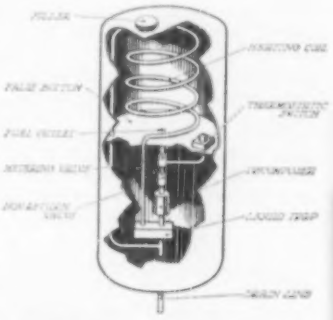


Checks Surfaces

Aircraft Surface Flushness Gage, offered by **Hi-Shear Rivet Tool Co.**, 1559 Sepulveda Blvd., Hermosa Beach, Calif., measures variance of countersunk heads, screws, rivets and other surface irregularities.

Four button-contact points of base and indicator stem are polished hard chrome. Indicator stem is fitted with thread adapter which provides up or down adjustment of the indicator button point to flat, concave or convex surfaces. Vertical adjustment of $\frac{3}{8}$ in. can be made.

Total indicator range is .075 in. with a minimum graduation of .0005. Unit is designated Model No. 1-B5M and weighs 7½ oz.



Heating System For Jet Fuels

A system for heating hydrogen peroxide fuel tanks has been developed by **A. V. Roe Canada, Ltd.** This will prevent the chemical from freezing and insure fast, reliable ground starting of jet engines.

Use of hydrogen peroxide for jet engine starting is advantageous because of its rapid decomposition into oxygen and steam upon exposure to a catalyst, and the great heat produced in the process. Drawback is its high freezing point (11 deg. F.), a problem which Avro's heating system is specifically designed to overcome.

▶ **Operation**—When the temperature of the hydrogen peroxide, contained in an upper reservoir, drops to a given value, a thermostatic switch mounted on the false bottom opens a metering valve, allowing a small amount of the chemical to flow through a non-return valve to a catalyst contained in the decomposer. The hot vapor generated in the decomposer passes first through a liquid trap then a heating coil bringing the fuel up to desired temperature which actuates the thermostatic switch to close the metering valve and stop the flow of fuel.

Excess vapor or condensate is drained overboard.

The entire unit is compact and lightweight. Simplicity of operation should preclude any maintenance problems that might arise.

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One of the largest fleets of aircraft maintained by any company for sales purposes is the fleet of six planes used by Van Dusen Aircraft Supplies. These aircraft enable our District Sales Managers not only to cover their territories more thoroughly but also to field-test and evaluate new equipment and products.

If you inspect any of our fleet of sales airplanes, you'll find it loaded down with radio equipment, instruments, and accessories. You'll also probably find that various surfaces of the wings and fuselage are treated with different finishes to see how they stand up under operating conditions.

With a fleet of six airplanes, the Van Dusen insignia is a familiar sight at many an airport.

This Van Dusen flying fleet means a lot to airline and airport service operators. They know that equipment and supplies handled by us are of highest quality and performance. They also know that the flying Van Dusen representative is thoroughly familiar with the products he handles and has a solid background of maintenance and service experience to provide intelligent assistance to solve any supply or equipment problem.

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Tuning Fork

Model 622B Frequency Generator, made by **Varo Mfg. Co., Inc.**, Garland, Texas, is tuning fork assembly designed to operate on 28v. aircraft power supply to provide constant, precisely fixed frequency sine wave voltage for control of 400c. electronic inverters.

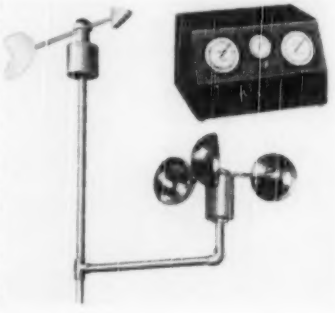
High stability of unit is revealed in output frequency which is 400 cps. ±1/10 percent over all specified conditions of load, changes in altitude and input voltage, and throughout a temperature range of −55 C. to 110 C.

Device consists of miniature compensated tuning fork of "radically new high Q design," electronic driving means, output transformer, thermostat, preheater and heater. All is contained in hermetically-sealed enclosure.

Besides its use with electronic inverters, this unit can be used with rotary inverters, alternators and various signal generators for airborne equipment. It also is useful as a time standard for counters, clocks, intervalometers and recording oscillographs.

Specifications are:

- Input—rated voltage, 28v. d.c.; minimum, 25v.; maximum, 29.5v.; minimum current, 100 ma.; maximum current, 1200 ma.
- Warmup—to rated output voltage, 10 sec.; warmup time, frequency (−55C.), 5 min.
- Life expectancy—1000 hours.
- Dimensions—height, 3⅝ in.; width 1⅛ in.; length, 3¾ in.
- Weight—11 oz.
- Output—voltage, 15v. minimum; frequency, 400 ±1/10 percent; wave form, sinusoidal; load resistance, 1 megohm.



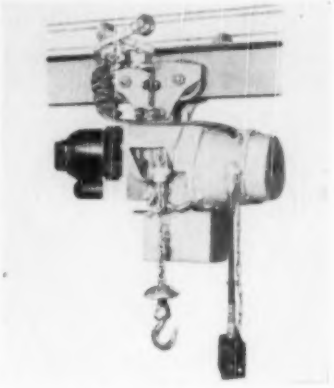
Wind Meter

Low-cost A-C-1 Windometer is made by **Aircraft Components, Inc.**, Benton Harbor, Mich. It consists of separate transmitters for wind velocity, direction, and outside air temperature. Three indicators are housed in a single case that can be installed in building.

Maker claims low cost makes it particularly suitable for use by small airport and fixed-base operators and claims it compares in quality and accuracy with higher-priced equipment giving it good competition.

Wind direction unit has completely sealed transmitter, using magnetic couplings to transmit position aluminum-alloy vane. A 3-wire, 3-coil d.c. Selsyn system is employed.

Wind velocity transmitter is mounted in sealed ball bearings and wind cups are aluminum alloy. Wind velocity indicator is electro-magnetic drag type, using self-generating 3-phase power. Outside air temperature equipment measure temperatures from −40 to 120 deg. F.



Electric Hoist

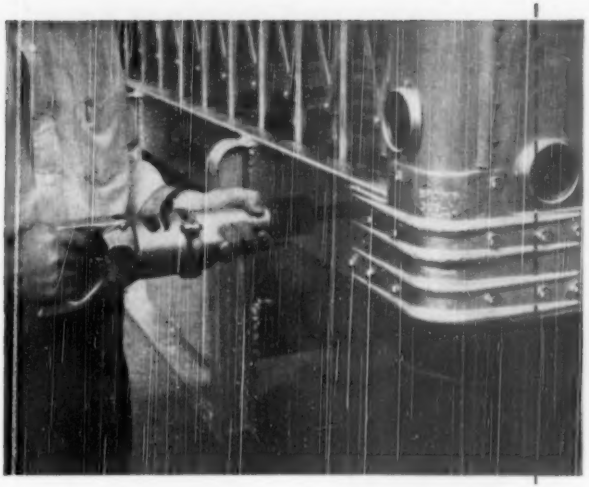
Chain-type Load King electric hoist, with lifting speeds up to 41 fpm., a lower and upper limit stop, and wide "pick-up" angle, is announced by **Yale & Towne Manufacturing Co.**, Philadelphia.

Available in load capacities of 500, 1000 and 1500 lb., standard models lift loads to heights of 40 ft.

Major feature is the long lift which is permitted. Link chain, over electrically driven sheave, supports the load, and wound-up chain does not wrap around drum but collects in metal container. For high lifts requiring long chains, all that is needed is larger chain container. The single-strand load chain engages six pockets of sheave to move and hold heavy loads with minimum of chain friction.

Hoist hook can extend 30 deg. from vertical to pick up loads. Limit stops break electrical circuit when the hook reaches predetermined levels.

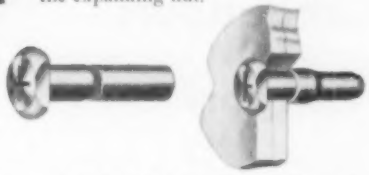
Hand controller is suspended by light-gauge chain so that neither electric cable nor electrical connections take the weight of the controller. The control box is situated at a level convenient to the operator. Flexible control cable carries only switch-energizing current.



NOW

you can speed heavy sheet metal assembly

Basically a blind mechanical rivet, the Blind Bolt saves you time and expense in production or maintenance. A three-piece assembly, the Blind Bolt consists of a hollow rivet, an inner screw and the expanding nut.



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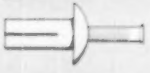
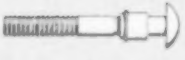


DRIVE PIN RIVETS. Ideal for fastening light sheet to heavier sheeting or to framework where rigidity is great enough to withstand hammering. As simple as hammering nails, you can save valuable time on sheet metal jobs with Drive Pin Rivets.



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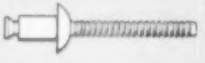

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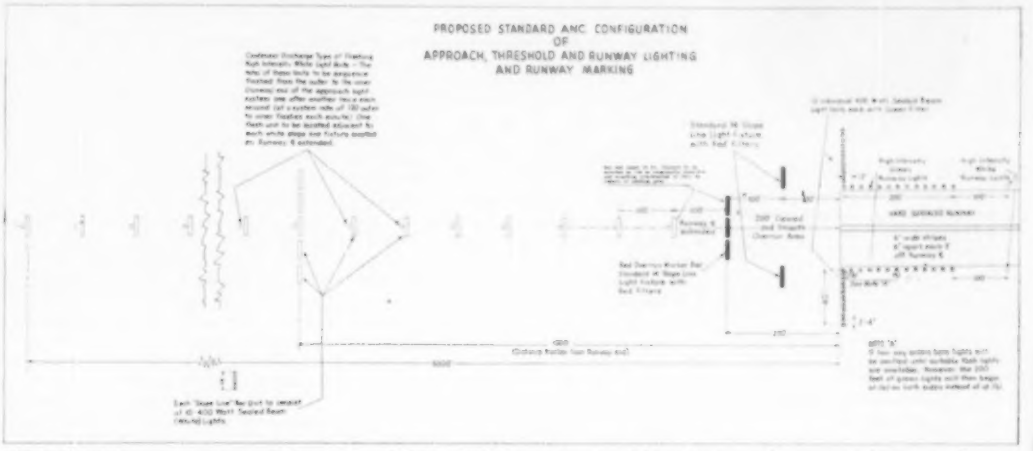


ALPA PLAN features condenser discharge type of flashing high-intensity white lights able to produce several billion candlepower.

CAA Pushes Approach Light Plan

But ALPA still prefers its own center-line system to the left-hand, single-row, ladder-type program.

The Civil Aeronautics Administration is stepping up the voltage on its lagging high-intensity approach light program.

Between a dozen and 15 of the busiest U. S. airports are slated to glow brighter by Nov. 1. But the Air Line Pilots Assn. is likely to make more sparks fly before CAA's plans are carried out.

Present indications are that the 15 sites being studied by CAA will have left-hand, single-row, ladder-type, high-intensity approach light lanes. The federal agency believes this procedure will satisfy most users of the new lighting facilities and lead to quick installation.

▶**Configuration Dispute**—Wrangling over the proper configuration has already delayed the multi-million-dollar approach light program. CAA feels that unless it starts installing the lights within the next few weeks they will not be ready for bad weather next winter.

ALPA says the left-hand configuration is undesirable and will make a determined fight to have its own center-line system installed. The pilots' union argues that the center line was not evaluated fairly while undergoing CAA-sponsored tests at Arcata, Calif., and elsewhere.

The military is the principal opponent of the center line. It refuses to endorse a system that does not have a 1000-ft. clear over-run area. A jet fighter reportedly washed out part of a center-line system during a recent landing at Indianapolis.

Besides, the military thinks the center line maximizes the danger of cockpit cutoff due to aircraft nose structure. It is argued that watching a center line would be extremely difficult from some plane cockpits even in a nose-down landing attitude.

▶**Airlines in Middle**—While top executives of at least two major airlines are backing the ALPA viewpoint, most carriers feel they are holding the bag in the approach-light squabble. They want improved lighting to permit lowered minimums and greater schedule reliability. The configuration, they feel, is of minor importance compared with the need for quick action.

Airline operations officials are expected to make an important policy decision on the high-intensity approach light controversy before the end of this month. It is feared that ALPA pilots may refuse to use the slope line or left-hand, single-row configuration. If CAA won't budge from its position, ALPA might go to Congress—to the detriment of the whole lighting program.

▶**Program Outlined**—These airports have been selected tentatively for high-intensity approach light installations by Nov. 1: Baltimore (Friendship), Philadelphia, New York (LaGuardia), Boston, Atlanta, Detroit (Willow Run), Houston, Dallas, Kansas City, St. Louis, Oakland, San Francisco, Burbank, Seattle and Portland, Ore. Land acquisition difficulties at some fields may make it necessary to install lanes of less than the desired 3000 ft.

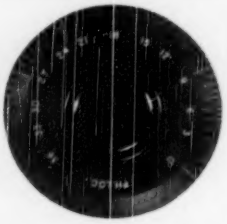
Lack of a 3000-ft. lane may mean reexamination of a project with a view to transferring it to another location. On the other hand, lanes of less than optimum length may be installed now and lengthened later.

Where existing 1500-ft., low-intensity, red neon lanes are involved, the high-intensity units will be located on the same left-hand line and stationing. This has already been done at Newark, where 2800 ft. of new lighting has been installed, and at Chicago, where a 1300-ft. lane is in place.

▶**Agreement on Fixtures**—There is no disagreement on the type of lights that should be used. They consist of the slope line bar unit with ten sealed-beam lights of about 90,000 candlepower. Existing red neon lights, installed at more than 90 airports, are rated at 1000-2000 candlepower. They have been used for over 15 years.

More than a year ago, over ALPA protests, the U. S. Munitions Board approved the CAA-backed, double-row, funnel-shaped slope line configuration as the U. S. standard. It was said that the slope line configuration gave the sharpest indication of direction, the only accurate indication of altitude among systems tested, and the most accurate information as to lateral position with respect to the approach axis.

During the past year, high-intensity approach lights with the slope line configuration have been commissioned at Washington National, Idlewild (New York) and Los Angeles Airports.



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Then, about five months ago, CAA withdrew its all-out support for the slope line configuration (AVIATION WEEK Jan. 23). Studies had shown that terrain problems made the slope line pattern impractical for many airports. As a result, the single-line, left-hand system is being installed as an alternative to the double row.

▶ **Experiments Continue**—CAA is still experimenting in an effort to improve both the slope line and left-hand configurations. Eighty-ft. crossbars at the threshold and 1000 ft. and 2000 ft. out from the approach end of the runway have been added to the slope line system at Los Angeles Airport. Red filters may be placed over the white lights on both the slope line and left-hand, single-row systems.

Use of red filters lowers the candlepower of the standard white lights by 70-85 percent. Tests are also under way to cut down the number of lamps in the slope line fixtures nearest the runways, or to reduce the intensity of the lights closest to the threshold.

Slope line fixtures now being installed by CAA were bought with fiscal 1949 funds. High-intensity lighting funds in the fiscal 1950 budget were diverted elsewhere.

▶ **Program Cut**—The fiscal 1951 budget originally called for 30 more installations of the slope line configuration, costing an average of $107,000 apiece. But the House reduced the program to 13 installations costing $1,391,728.

Use of the single-line, left-hand system should stretch CAA's approach light money over more projects, since fewer lights and fixture-mounting locations are required. However, the cost of the power supply and controls varies little between single- and double-row configurations.

In explaining its opposition to both the double-row slope line and single-row, left-hand configuration, ALPA asserts that neither of these patterns is preferred by pilots who participated in light evaluation tests.

These weaknesses are attributed by ALPA to the dual-row slope line:

• **Inability** to determine left from right row when both rows are not observed simultaneously. (This is particularly noticeable during low daytime visibility.)

• **Confusion** between approach and runway lights, resulting in landings in the approach zone.

• **Color differentiation** of the rows is impractical.

• **Two rows** which converge toward the runway center line create an optical illusion of exaggerated glide path or pitch angle. This causes the runway to appear uphill.

• **Poor center-line identification** under low visibility conditions. Natural pilot tendency is to hug the row of lights. If the pilot guides on the right-hand row, mistaking it for the left, a missed approach is likely to result.

• **Cost** of acquiring land is too high.

Left-hand row faults, according to ALPA, are:

• **No center-line** identification.

• **Confusion** when approaching in a cross wind. (The plane appears to be either closing on, or drifting from, the lights, with a resulting tendency by the pilot to change heading in order to parallel the lights. If this is done, the plane will drift off course.)

• **Visible** only to pilot in the left-hand seat. This nullifies the safety feature of the second pilot.

The pilot union adds that the slope line and left-hand systems do not recognize the importance of defining the end of the runway or provide for guidance beyond that point.

▶ **ALPA System**—Center-line system endorsed by ALPA is intended to correct these faults. It is said to eliminate the possibility of confusion; to give positive and early identification of the runway, and strong definition of the runway center line; and to offer positive roll or bank guidance 1000 ft. out and again at the runway threshold.

Lights in the ALPA center-line system are the standard 14-ft. slope line bars containing 10 sealed-beam, 400-watt lamps. The row extends 3000 ft. from the runway center line, with one crossbar 1000 ft. out.

▶ **Super-Brightness**—The condenser discharge type of flashing, high-intensity white lights are in front of each slope line bar unit. These special lights have extremely high power—up to several billion candlepower—and flash from the outer to the inner end of the approach light system 120 times a minute.

ALPA says the duration of the flash is so short—17 to 200 micro-seconds—that it does not affect day or night vision. The flash is described as appearing like giant tracer bullets fired toward the runway. It is said to provide a "point source" of light against the large area glow from steady burning lights during rain, snow or fog.

The condenser discharge lights are of great value in identifying the center of the light row and assuring the pilot that the linear bars will soon be visible, according to ALPA. These flashing units can be seen when at an angle to the runway, as when circling, and stand out against other city lights. Directional characteristics of present sealed-beam lights make them visible only when the plane is lined up with the runway.

• **Used since 1947**—Original condenser discharge lights were installed at Newark in 1947. They were tested at Arcata, and Cleveland has a partial system. ALPA believes they will make up for the loss of intensity if red filters are used on the slope line bars.

Critics of the condenser discharge lights say they are too expensive and are blinding to some pilots. Cost of one type of condenser discharge unit is estimated at about $1500 per unit and another type at about $2500 per unit, compared with the comparatively inexpensive $145 per slope line unit.

The ALPA center-line system also has a 200-ft. clear over-run area outlined in red filtered lights and green filtered threshold lights. A double row of six-inch-wide stripes is painted along the runway center line to insure easy guidance.

Mail Pay Rise Will Put CAL in Black

Continental Air Lines will soon rub out the red ink tentatively placed on its books during 1949, thereby making the year profitable for nearly all the 16 domestic trunk operators.

Initial figures showed Continental with a $229,000 net loss for 1949, making it the only domestic trunkline besides Northwest to finish in the red. But now the Civil Aeronautics Board has offered to increase CAL's 1949 mail pay by $473,000, giving the company a substantial profit for the year. Mail rates in 1950 will also be raised.

▶**Works Both Ways**—CAB's action wasn't all to the good. The Board decided that the carrier's $183,000 net profit in 1948 provided more than a 7 percent return on company investment. So mail pay for that year was shaved $61,000—still leaving CAL with a tidy profit.

In analyzing Continental's deficit operations last year, CAB found that the sharp drop in passenger load factor from 49 percent in 1948 to 41 percent in 1949 could be traced to the company's replacement of 21-passenger DC-3s with 40-passenger Convair-Liners. Passenger-miles flown gained more than 11 percent during the year, but not enough to fill the 34 percent more seats available.

Nevertheless, CAB found no fault with Continental's decision to buy five new Convairs. When the order was placed in 1946, it seemed that DC-3s would have to be disposed of by the end of 1948 because they were unable to meet CAB's transport category requirements. (The deadline has since been extended more than two years to Dec. 31, 1953.)

▶**Plane Prices Rise**—Besides, CAL contracted for its Convairs at a price considerably under their present quotation. The Board points out that Continental will need a DC-3 replacement in the next several years. It feels there is considerable question whether Continental could ever get new transports at a price equal to, or lower than, the 1946 tag on the Convairs.

In view of the low traffic density on CAL's routes, it is natural that economical integration of Convairs on the carrier's system has proved difficult, CAB said. However, the Board found that Continental had not shown a tendency to over-schedule, and as traffic grows in future years the Convairs should begin to pay off.

Continental's future mail rate is of the incentive sliding-scale variety, whereby payments decrease as passenger load factors rise. CAB figures the new rates will enable CAL to break even at a 37 percent passenger load factor and make 8 percent profit at the expected 45 percent load factor.

STANDING ROOM ONLY

Completion late this year of a $1.5-million extension of Washington National Airport's administration-terminal building will ease, but not eliminate, the housing shortage at the nation's third-busiest commercial field. Civil Aeronautics Administration, which operates the airport for the government, says would-be tenants have already applied for more space than is available in the new structure. A drug store and branch bank appear to be two sure additions to the array of concessionnaires now in the terminal. Temporary airline offices lining the north and south concourses of the present building will move into permanent quarters, permitting expansion of waiting-room space in the lobby. Extension adds 61,000 sq. ft. of space to the terminal's present 111,000 sq. ft.

Edo NEWS NOTES

This year, we at Edo are marking our 25th Anniversary. On September 28, 1950, we will have completed a quarter of a century of service to the aviation industry, the armed services and, more recently, the field of electronics. During these years the Edo Flying Fish has become a familiar mark on a wide variety of projects ranging from seaplane floats to intricate electronic underwater detection equipment.

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This Flying Fish insignia is as old as Edo itself since it was inspired by our first project—an all-metal flying boat built in the company's initial 30 by 60 foot hangar in 1925. This 110 hp seaplane was named the "Malolo", a type of flying fish found in the Pacific.

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The "Malolo" project led to the development of Edo seaplane floats which have since earned a world-wide reputation for performance and stamina. The exacting skills required in building light, strong, leak-proof floats have since been applied to the design and manufacture of many different intricate aluminum components. And now our Electronics Division is playing a leading role in the development of significant underwater detection equipment.

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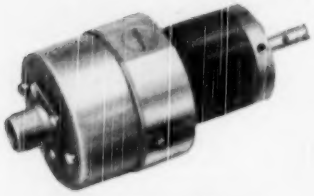

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MASEFIELD—Turboprop is traffic magnet.

BEA's Choice

Masefield sees needs for piston-engine, turboprop and jet transports.

The chief executive of British European Airways, which next year may become the first carrier in the world to fly turboprop transports in scheduled service, says tests have already determined the proper niche for his new ships when competing with turbojet and reciprocating-engine aircraft.

Peter Masefield believes that for some time to come piston-engine transports may be the most desirable on routes up to 400 miles. "For stages of 500-1000 miles, the project is even now very attractive," he declared, adding that "for stages of 1500 miles or over the straight jet is the answer."

► **Traffic Magnet**—Masefield, former director of long-term planning and development for Britain's Ministry of Civil Aviation bases his conclusions on experimental operations with the de Havilland Comet jet transport and the turboprop Vickers Viscount. These two aircraft, Masefield asserts, have set a new standard of passenger comfort which will draw traffic to the lines using them.

BOAC has ordered 14 Comets and BEA has ordered 20 Viscounts. The 36-passenger Comets are expected to go into commercial service on Empire links early in 1951, and the 40-passenger Viscounts will be placed on Continental routes soon afterward.

► **Easy Maintenance**—Masefield said that after 8000 miles of flying around Europe, the only maintenance operations performed on the Viscount were the changing of one fuel pump actuator and the topping up of one oleo leg. The Comet, he declared, has already flown more than 200 hours and also is proving that lack of vibration in turbine-engine aircraft means low maintenance costs.

Comparing the three types of transports on a 200-mile route (roughly New York-Montreal), Masefield estimated the piston-engine ships would operate at $2.00 per mile, the turboprop at $2.22 and the straight jet at $2.50. This assumes six 44-passenger planes of each type flying seven hours a day.

► **Costs Compared**—On an hourly basis, the operating cost of $128.80 for the piston type, $140 for the turboprop and $221.20 for the straight jet shows a much larger spread. But since the turbine planes would make the same number of trips in fewer flying hours the total costs are comparatively close.

Whereas on a 200-mi. run the turbojet would be about 20 percent more expensive than a piston transport, the situation changes as the route lengthens. On a 900-mi. stage, Masefield estimated, plane-mile operating costs would be about the same for the piston transport and the turbojet, with the pure jet 11 percent higher. In view of the added passenger comfort for the turboprop compared with the reciprocating-engine ship, at no extra cost, the former would attract the traffic.

Over the 1500-mi. stage, the turboprop shows a one-hour time gain and the straight jet 2½ hr. over the piston type. Operating costs are again about equal for the piston and turboprop types; but the fast turbojet, with costs now only 9 percent more, would be likely to assume dominance.

Another Late 631 Flying Boat is Lost

(*McGraw-Hill World News*)

Paris—France's 70-ton, six-engine flying boat Latecoere 631 became a strong contender for the title of the world's unluckiest airplane last month when one of the big ships plunged into the sea off the French west coast recently killing its entire crew of 10.

This was the latest of a series of disasters which has whittled the original fleet of eight Lates down to four. It probably will be the last since odds are they now will be grounded for good.

Cause of last month's crash still is unknown. The Late was on a test flight when it exploded and the wreckage pitched into the sea.

► **Tragic Ship**—The Latecoere's past was as romantic as it was tragic. The big ship was designed and two prototypes partially built before the war. The Germans captured one prototype, finished it and flew it to Lake Constance where it was sunk by the RAF.

The second prototype was disassembled by the French Resistance under the noses of the Germans and hidden throughout the war.

Eight Lates were built for Air France after the liberation. The first one threw two propellers while flying up the coast of South America, killing two journalists who had been invited on the flight to write up the plane. The Argentinians abandoned plans to buy a fleet of Lates.

The Latecoeres next were put on Air France's Antilles run. Despite the fact that they were very comfortable and carried 50 passengers they flew in the red due to high operation cost.

Only a few months later a 631 pitched into the English Channel in a snowstorm. The weather and inadequate navigational and communications equipment were blamed.

Then in July 1948 a Latecoere coming from the Antilles on a scheduled Air France run disappeared without a trace with 53 passengers and crew aboard off the Azores. Air France promptly washed its hands of the flying boats.

A commercial company was formed to redesign and perfect the remaining 631s with the object of using them eventually as colonial cargo planes. A successful test flight from Biscarosse to French Equatorial Africa had been completed by one of the ships just before last month's accident. Chances are it will be the last.

Western Plans to Dissolve Inland

The nation's 16 domestic trunklines soon may be reduced to 15.

Western Air Lines is planning complete dissolution of Inland Air Lines, now operated as a division of WAL. Inland has not been an independent carrier since May, 1944, when the Civil Aeronautics Board approved Western's acquisition of control through purchase of 83 percent of the smaller carrier's stock. But Inland has continued to report its traffic and revenues separately from Western.

Now, however, Western has decided against continued existence of Inland as a corporate entity. Steps to dissolve Inland, pursuant to Wyoming laws, will be initiated as soon as CAB grants approval. Since 1944 WAL's stock in Inland has grown to nearly 98 percent.

SHORTLINES

▶ **Air Line Dispatchers Assn.**—Reports a new contract with Braniff providing a starting wage of $375 monthly, the scale rising to $550 a month in the seventh year. Foreign service carries a $100-per-month bonus. Pact is effective to July 1, 1951.

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(2) **Ground Fault Relay**–Senses ground fault; when fault exceeds set value, relay de-energizes generator.

(3) **Overvoltage Selector Relay**–Senses load current to detect generator producing overvoltage and automatically sets its overvoltage relay to trip at lower voltage than other five relays.

(4) **Equalizer Relay**–Disconnects regulator equalizing circuit from equalizer bus to avoid pulling system voltage down when generator is inoperative.

(5) **Overvoltage Relay**–Senses overvoltage and cuts out generator. Relay has inverse time characteristics to prevent nuisance trips.

(6) **Contactor and Dropout Relay** *(Not Shown)*–Located in fuselage near main bus, six of these compact units, each controlled by a GC-18 panel, connect and disconnect generators from bus during both starting and generating conditions.

Typical of Hartman design and manufacture, relays in the B-47 are just a few of the many d-c devices engineered for the aircraft industry. Whenever your problem involves d-c controls, turn it over to Hartman where it will receive prompt attention . . . where it will be analyzed and engineered with an efficiency that comes from nearly half a century of specialization.

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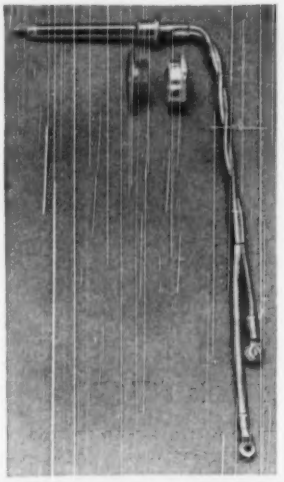

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UNITED STATES STEEL

► **All American**—CAB has placed in effect higher mail rates designed to relieve the burden of carrier's critical financial position as reported in AVIATION WEEK May 15.

► **American Overseas**—Has completed its 20,000th trans-Atlantic crossing. . . . Company is operating 21 trans-Atlantic schedules per week and providing 27 percent more seating capacity as compared to the same period last year.

► **Capital**—CAB has authorized extension of Capital's route 14 from Pittsburgh to New York, making possible nonstop service between New York and Cleveland and fast single-plane service from Muskegon, Grand Rapids, Lansing and Flint, Mich., to New York. With two members dissenting, the Board also placed a restriction on Capital's operation which will force the company to make at least two intermediate stops instead of one on its pioneer New York-Chicago air coach run.

► **Consolidated Vultee**—Claims an unparalleled safety record for its Convair-Liners which recently completed their second year in service without a fatality. The more than 150 Convairs now in use have flown over 1480 million passenger-miles in foreign and domestic service. The 75 million plane-miles flown equals 3000 trips around the world. Airlines using Convairs are: American, Pan American, Western, Continental, Northeast, Mid-Continent, KLM, Swissair, Sabena, Orient Airways (Pakistan), Trans-Australia, Fama (Argentina) and Garuda Indonesian Airways.

► **Delta**—Has asked CAB for permission to extend its routes from Columbia, S. C., to Washington and New York via Fayetteville and Wilson, N. C., and Philadelphia.

► **Eastern**—President E. V. Rickenbacker concedes that EAL's freight business is still in the red and may continue to lose money for five to ten years. . . . Company's continued high traffic level in April and May should boost earnings above the same period last year. . . . A CAB examiner has recommended that EAL be permitted to serve Lumberton, N. C.

► **Frontier** — The Rocky Mountain feeder's 4900-mi. system (combining routes of Challenger Airlines, Monarch Air Lines and Arizona Airways) is larger than eight of the 16 certificated domestic trunklines. Service on the 47-city, 7-state trunkline network began June 1.

► **Inland**—Plans to start service to Mankato, Minn., around July 1.

► **Los Angeles Air Service**—The uncertificated operator has asked CAB for exemptions to serve Del Mar, Calif., during the six weeks' summer racing season and to make charter flights to Los Angeles Bay and La Paz, lower California Mexico, during the sport fishing season.

► **Mid-Continent**—Wants CAB to suspend Chicago & Southern Air Lines' proposed Chicago-St. Louis-Memphis-Jackson-New Orleans air coach service slated to begin July 2. MCA says the proposed fares are unreasonably low and would depress all fares in the area. The complaint contends the C&S route does not have enough traffic to support air coach without considerable diversion of regular-fare business, including that handled by Mid-Continent.

► **National**—May revenue passenger mileage gained 35 percent over last year. Company officials credited their packaged vacation program with boosting business during what is normally NAL's slackest month of the year.

► **Northwest**—Domestic passenger revenue for a single day passed the $100,000 mark for the first time in NWA history during the Memorial Day holiday.

► **Regina Cargo Airlines**—CAB has opened hearings on the carrier's C-46 accident near Teterboro, N. J., airport, May 27. The plane crashed shortly after takeoff, killing the pilot and seriously injuring the copilot. There were no passengers aboard.

► **Slick Airways**—President Earl Slick has urged Congress to pass legislation to strengthen the fleet of all-cargo aircraft instead of prototype bills to construct or test passenger-type aircraft on which much time and money must be spent before they could be converted to military use in an emergency. "National-defense-wise it seems more reasonable to encourage existence of volume, all-purpose airlift than to match the British in turboprop, high-speed, passenger transports."

► **TWA**—CAB has reissued the carrier's certificate to reflect the corporate name change from Transcontinental & Western Air, Inc., to Trans World Airlines, Inc. . . . Carrier wants permission to eliminate Columbia, Mo., as an intermediate point. Authorization to serve the city was granted in 1943, but inadequate airport facilities have prevented inauguration of service.

CAB SCHEDULE

June 19—Oral argument in Florida Airways mail rate case. (Docket 3695)

June 19—Prehearing conference in enforcement proceeding against Air Transport Associates, Inc. (Docket 4265)

June 19—Prehearing conference on application of Lineas Aereas Costarricenses for a foreign air carrier permit to operate between San Jose, Costa Rica, and Miami. (Docket 4198)

June 20—Hearing in CAB enforcement proceeding against Metropolitan Air Freight Dept. (Docket 4319)

June 20—Prehearing conference on enforcement proceeding against Arctic-Pacific, Inc. (Docket 4285)

June 21—Hearing on proposals of Braniff, Continental and Pioneer to reduce excess baggage charges. (Docket 4320)

June 22—Oral argument in enforcement proceeding against Golden North Airways, Inc. (Docket 4150)

June 26—Oral argument in Western-Inland mail rate case. (Docket 2870 et al)

June 26—Hearing in Florida-Bahamas service case. (Docket 2824 et al)

June 29—Oral argument on applications of Colonial Airlines and American Airlines for service to Toronto. (Dockets 3853 and 4932)

July 10—Resumption of hearing in Colonial Airlines mail rate case. (Docket 2724)

July 17—Hearing on Lehman Brothers' interlocking relationships case involving partners of firm holding airline directorships. (Docket 3805 et al)

Sept. 26—Hearing on Mid-Continent Airlines' application to have its route 86 certificate (Tulsa-Houston) made permanent. (Docket 3692)

Oct. 16—Hearing on Los Angeles Airways' application for renewal of its helicopter mail-cargo certificate and for additional authority to carry passengers. (Docket 3860)

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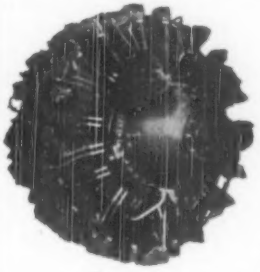

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LETTERS

Reverse Thrust Cost

This is in answer to your note of April 18, with regard to the cost estimates of reversing-thrust propellers. Your article April 10 sets forth the cost of estimates of my report correctly.

The estimate of $335,000 per plane, for the L-49, appeared high to us also. However, this figure was an approximation supplied to us by Lockheed and we had no reason or basis on which to alter their estimate.

There are several possible reasons for the disparity between the cost estimate of the L-49 and that of the DC-4. One reason may have been that the L-49 costs were based on the installation of Hamilton Standard hydraulic propellers which would require more extensive engine modifications than the installation of Curtiss electric propellers on which the DC-4 figures were based.

A second reason may have been the relatively small number of airplanes involved. The DC-4 costs, if based on the same number of airplanes, would have been much higher on the "learning curve" and would have been more realistic. It may be possible also that the cockpit changes required for the L-49, such as the control pedestal, etc., are more extensive than for the DC-4.

It is possible that the overall cost estimate of all the L-49 and DC-4 airplanes is not too far wrong since it averages the two extremes.

In conclusion let me thank you for a very fair and accurate report of my statements to the House Interstate and Foreign Commerce Committee.

John M. Chamberlain, Director
Bureau of Safety Regulation
Civil Aeronautics Board
Washington 25, D. C.

Barnacle Navy?

The letter by K. S. B., April 24 issue, castigating the Navy for retaining the propeller-driven F4U Corsair in production at a time when the F-80 is ceasing in production moves me to a few words in defense of the venerable Corsair. Happily, K. S. B. softens the blow by indicating that the Navy must have "technical reasons for still wanting the old Corsair." I venture to observe that the Navy has plenty of reasons—not all of them "technical."

I cannot convince myself that the Navy is as barnacled as K. S. B. implies. The April 24 issue of Aviation Week gave a score of 90 F-84s vs. 9 F9F-2s "shot down" in Operation Portrex. I have noticed no claims to the effect that the F2H, F3D, and F7U are second-rate. The Navy does have a few fighters we can fall back on—jet propelled, too! And did I not see a letter in your magazine suggesting that we turn the Navy fighters over to our land-based cousins because carrier aircraft have superior performance?

Finances enter the picture in a rather abrupt way. The same money that buys one Banshee might buy 8 or 10 Corsairs. And I know a few marines who would rather have 10 Corsairs on station overhead than one jet limited to a pass or two at low altitude. I have an idea that in the event of an emergency, our ground forces would put up a howl for something like the F4U or F-51—in vain. You can bet the opposition has not resorted to the same error. The poor low altitude endurance of jets and turboprops was well illustrated in the April 24 issue.

Another factor is the item that while we have numerous carriers, none were designed for jets, and few have been modified. The British are building 10 new carriers (using our money no doubt!) while we are not even considering plans to cut the slowly tightening noose around the neck of Naval aviation. If we had a rule to the effect that land air bases are restricted to prewar runways and facilities, I think you would find that we might be still building a few F-51s, just to be able to use those bases to the fullest extent.

I for one have been concerned for fear the Navy would drop the Corsair and Skyrauder from production. What would you design to do their job? I am all for progress, but I feel we would be sadly amiss if we drop these models unless we have something that can do the same job—and do it better.

Hugh L. Hanson
1515 Fairfield Street
Glendale 1, Calif.

'Time to Live'

It was with surprise and pleasure that I read the editorial "Time to Live," in which you commented on my efforts to sell more individuals on the many advantages of flying. . . .

Robert Simonson
District Traffic Manager
Continental Air Lines, Inc.
Wichita, Kansas

Belatedly, I congratulate you on the editorial, "Time to Live," published in your excellent magazine. This was a fine piece of work on your part and excellent publicity for our boys. . . . You are doing a fine job with Aviation Week. . . .

Robert F. Six, President
Continental Air Lines, Inc.
Denver 7, Colorado

Westinghouse Too

Mr. J. P. Barbour, manager of our Aircraft Department at the Lima Works, noted the article April 17 covering the ATA meeting at Kansas City and was quite concerned that the name of Westinghouse was omitted from the list of firms that have developed over-voltage protection systems.

Westinghouse is definitely engaged in this type of activity.

Gordon Dille, Technical Press Service
Westinghouse Electric Corp.
Pittsburgh 30, Penna.

(*We are sorry; apologies to Westinghouse. At a press conference the discussion leader listed manufacturers of such equipment and omitted Westinghouse inadvertently.—Ed.*)

WHAT'S NEW

New Books

Supersonic Aerodynamics by E. R. C. Miles, Johns Hopkins University, is a rigorous mathematical treatment slanted at the senior or beginning graduate student in aeronautical engineering. The text is an outgrowth of a course in supersonic aerodynamics given by the author.

Reviewing such a volume is a difficult procedure—mathematical treatments, however brilliant, do not lend themselves to abstracting or quoting. But it is apparent that the author has collected in a single text the basic tools for theoretical investigation of the subject, and for the understanding of the current crop of professional literature in the field.

In his mathematical concepts, Miles has gone into great detail, so that there is a minimum usage of "It is obvious that . . .", a device damned by most students to whom it is not obvious. Further, his text is up to date with coverage of recent developments, including some previously unpublished material.

A large number of problems is included, and there the student will encounter both simple numerical applications and complete theoretical proofs.

Published by the McGraw-Hill Book Co., 330 West 42 St., New York 18, N. Y. Price is $4.

Technical Sketching and Visualization for Engineers by Hyman Katz is a practical how-to-do-it book offering engineers a direct means of expressing ideas without recourse to wordy written details. Given is step-by-step instruction on freehand drawing, use of drawing materials, planning and execution of the orthographic sketch, the oblique projection and the perspective sketch from a model. Included is a chapter on lettering.

Published by the Macmillan Co., 60 Fifth Ave., New York 11, N. Y., 504 illustrations, price $5.

New Literature

Chart giving complete tabulation of state laws affecting civil aviation throughout the U.S. and possessions and territories is available on request to pilots, airport operators, and others interested in state aviation legislation. Write U.S. Dept. of Commerce, Civil Aeronautics Administration, Washington 25, D. C. . . . Designers and engineers having blind fastening or riveting problems can obtain a new 20-page **data book** on Rivnuts by writing on company letterhead to B. F. Goodrich Co., Akron, Ohio.

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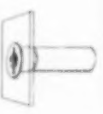
Complete Installation in Seconds

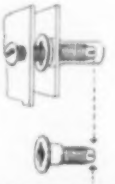
1 Drill one (1) hole.

2 Insert Lok-Skru with either Hand or Power Lok-Skru Tool.



3 With Lok-Skru Tool draw barrel over shoulder of Lok-Skru and flush with metal. This provides a Blind Anchor Nut for Secondary Attachments.

4 TO FASTEN ATTACHMENTS insert standard Machine Screw through hole in attachment and into Lok-Skru. As machine screw is tightened into Lok-Skru it is securely locked by means of the "Specially Crimped" locking-end of the Lok-Skru.



Crimped internal threads of Lok-Skru provide secure locking device for attachment screw.

THE AVIATION STANDARD

for Screw Locking Anchor Nut Uses and Metal to Metal Fastening.

Write for Folder

Handy information on the many uses and application of Lok-Skrus in airplane construction with complete data on types and sizes.

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Announcing . . .

The Aviation Week Fellowship In Aeronautical Engineering

Human progress is based on knowledge. A time-honored test of the standing of an individual (or organization) in a community is the support he gives to the educational system. By that test, the aeronautical industry has been remiss in obligations stemming from its citizenship in the aviation community.

AVIATION WEEK now is completing a national survey of scholarships and fellowships in aeronautical engineering awarded by individuals or firms in aviation. Results of the survey will appear in a forthcoming issue, with a complete list of all accredited universities and colleges offering approved courses in aeronautical engineering.

But already it is obvious that the aviation industry—so dependent for its progress on research and advanced study—has done and is doing all too little to promote such study.

For a student of modest means, advanced study may be impossible because of its cost. Awards of medals, plaques, trips and other such honors to a student may signify a certain recognition of his work, but the most practical assistance he can win is financial aid to complete his studies.

In appreciation of its role in the aviation community, AVIATION WEEK is gratified to be able to announce the establishment at the Massachusetts Institute of Technology of the "Aviation Week Fellowship in Aeronautical Engineering."

The Fellowship carries a stipend of $1800 per year, and is awarded annually to a male U. S. citizen enrolled for an advanced degree in the Department of Aeronautical Engineering of MIT.

The recipient is selected by MIT according to its own policies. This publication does not define the requirements nor choose the winner.

The science of aeronautics has vastly increased in complexity. It has been stated that the airplane is the most completely engineered man-made structure, reflecting facets of every science. Until recent years, metallurgy, chemistry, electronics, medicine and some other sciences were not vital to the aeronautical engineer.

From these sciences the aviation industry now is drawing the strength of progress. Aviation has most to gain from such progress. Only a dynamic industry survives. Yet, it can be shown that the aviation business is falling behind in providing the necessary tool—knowledge—that makes progress possible.

Greater knowledge means more study, the expense of which often dissuades promising students. A noted educator recently pointed out that many of the most promising students of our colleges and secondary schools were those who would be financially hard-pressed to pursue advanced study. Aviation looks to the laboratory and the classroom for its future growth. Is it not fair to suggest that aviation should aid those students?

AVIATION WEEK realizes it is part of the aviation community. It, too, will progress only as the industry progresses. It has long sought new ways to contribute tangibly to that progress. The Aviation Week Fellowship is a part of this program.

Winner of the Fellowship for the academic year 1950-51 is Herbert Matthias Voss. Mr. Voss is in the Honors Group in MIT's Department of Aeronautical Engineering at MIT and will receive both his Bachelor of Science and Master of Science degrees in June, 1951. Mr. Voss was selected by the Department of Aeronautical Engineering at MIT, with the approval of the Committe on Graduate School Policy.

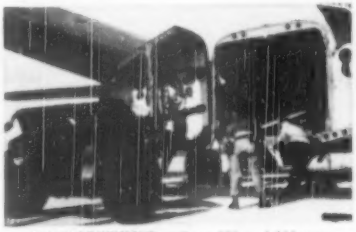
It is intended that the Aviation Week Fellowship be awarded annually to a recipient who qualifies. In this manner, an earnest student of the science of aeronautics may carry on his work for several years under the Fellowship award.

Leadership always brings responsibilities. AVIATION WEEK, as the leading U. S. aeronautical publication, is mindful of its responsibilities to the aviation industry that made its success possible. It is in this sense that AVIATION WEEK is gratified to be able to offer its services as a citizen of the aviation community in furthering the pursuit of aeronautical knowledge.

We are not jealous of this role. To the contrary, we hope that others in aviation will give attention to the extreme necessity of aiding aeronautical study. It would be beneficial to aviation if future surveys of aeronautical engineering scholarships and fellowships could include the names of many more aviation leaders.

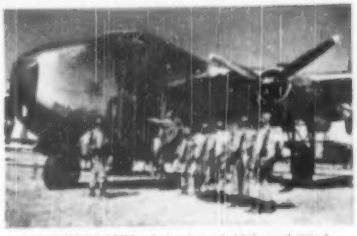
AIRHEAD

Established and Maintained *Entirely by AIR!*

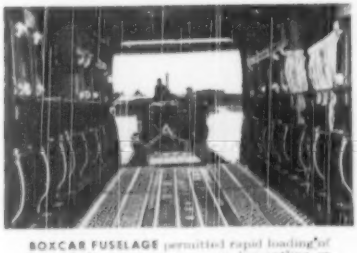


HEAVY EQUIPMENT such as 105 and 155 mm howitzers, 6000 lb. trucks and jeeps, rifles, ammunition, dropped from Packets—ready for use as soon as it hits the "drop zone"...

EASE OF LOADING from the rear of the fuselage allows for rapid loading and unloading in record time... Packets being airborne in as little as seven minutes after touch-down!



PARATROOPERS of the famed 11th and 82nd Airborne Divisions loading into FAIRCHILD Packets of the 314th Troop Carrier Wing during Swarmer's "D" day...



BOXCAR FUSELAGE permitted rapid loading of large, bulky equipment ... no dismantling or ground handling equipment needed. Vehicles loaded and unloaded under their own power!

Exercise Swarmer, the all-air maneuver in North Carolina, closed in May on a high note of success. It proved that an entire air-head *can* be established . . . supplied . . . and re-supplied *entirely by air!*

Contributing much to the success of "Swarmer" was the performance of Fairchild C-119 and C-82 Packets.

The new C-119's passed their initial tests with "flying colors" and well they might, because this was a *made-to-order* job for the Fairchild planes, with quick and easy-loading and unloading of men, equipment and other bulky supplies.

Packets, specially engineered and built for use by America's united air and ground forces, are proving themselves every day, under all operating conditions.

ENGINE AND AIRPLANE CORPORATION

FAIRCHILD *Aircraft Division*

3 TONS A MINUTE...

. . . of air pours through this intake when the new North American F-95 is flying top speed. Yet the J47 turbojet inside handles this easily and operates reliably, efficiently, and without vibration.

The Air Force's newest interceptor, a stablemate of the speed record-holding North American F-86, is designed for the high speed, high-altitude flight necessary to knock down enemy fighters and bombers. Teamed together, the F-86 and F-95 provide both offensive and defensive air power. Both use General Electric J47 turbojets for high performance under tough conditions.

As the G-E TG-190, this same engine has been certified by the CAA as the first axial-flow turbojet suitable for commercial use. In tomorrow's commercial transports, the TG-190 can provide the same speed, comfort, and dependability that are today built into the fastest and most powerful Air Force planes.

And in addition to the powerplant, General Electric also provides integrated engineering service that assures you of co-ordinated propulsion and electrical systems. From the designer's drawing board to the far-flung outposts of operational aircraft, General Electric's aviation experts can help *you*. Call your nearest G-E sales representative or write Apparatus Department, General Electric Company, Schenectady 5, New York.

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